POWER

POWER GENERATION,
ANSMISSION, APPLICATION
D THE ATTENDANT SERVICES
IN ALL INDUSTRIES

TECHNOLOGY DEPT.

MARCH, 1942

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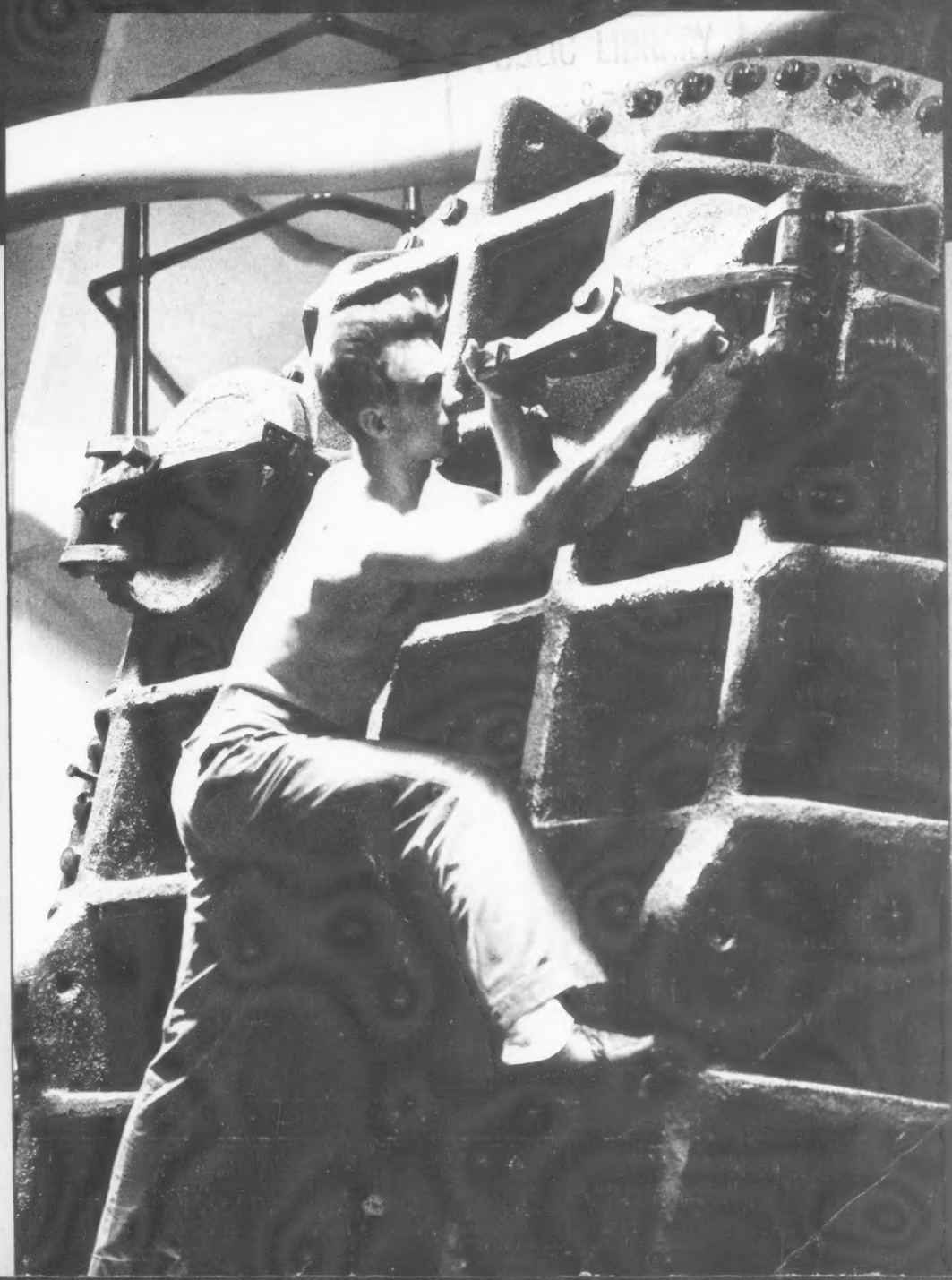
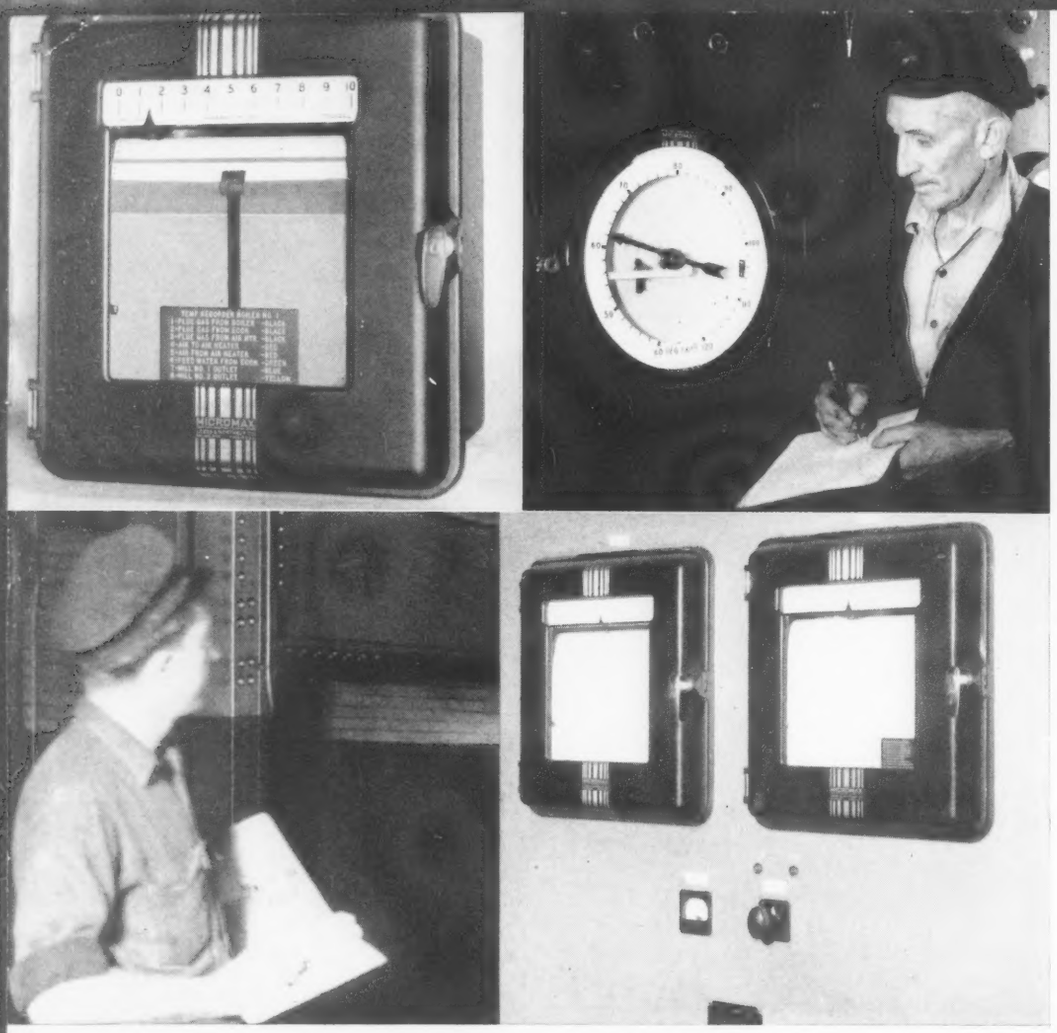




Typical Micromax Recorders In Steam Stations

RECORDERS "*Micro-Responsive*" TO POWER-PLANT NEEDS

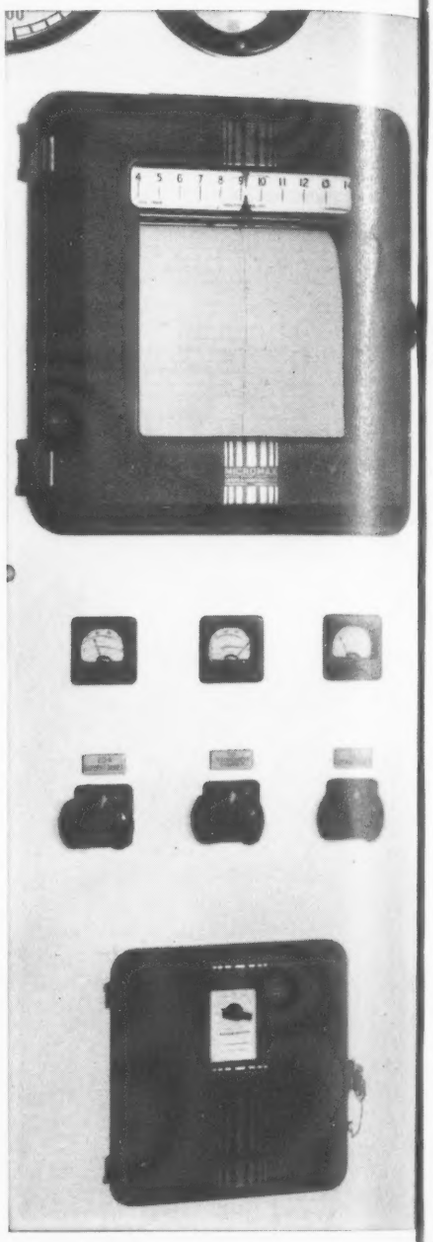
The ever-growing web of temperature-measuring circuits, spun by operating engineers and by meter and test men in power plants, has been greatly simplified in many places by what amounts to standardizing on Micromax recorders. Shown here are typical views taken in such plants, and presenting some of the instruments of their low-maintenance, high efficiency, temperature-measuring networks.

Most users of these recorders say that the sensitivity and accuracy of the instruments have much to do with their success. But fully as much credit is given to the concentrated, specialized instrument engineering which has tailor-fitted these pyrometers to the individual needs of the processes found only in power generating and distributing plants.

For example, Micromax boiler-temperature recorders: Here, a Micromax strip-chart recorder of appropriate temperature range starts with the temperature of incoming air and shows temperatures through the preheater, economizer, superheater, boiler passes and stack. Highly specialized engineering has gone into the development of thermocouples for many of these positions, and the Micromax recorder has likewise received specialized engineering to make fully available its unique "micro-responsiveness" to the needs of power-plant operators.

For compact, well-illustrated information regarding Micromax, ask for Catalog N-33-163, sent on request.

Jrl Ad N-163(7)



First Catalog Ready On Micromax Control Of Superheat

Micromax Superheat Control handles the damper just as a man would, if he had nothing else to do. That is, it moves the damper *in proportion* to each change in temperature. The Controller is seldom entirely still, but seldom moves abruptly or widely; temperature is held smoothly and constantly within the desired narrow band.

This method of control has been successfully used in various plants for some time, and the equipment is now cataloged in a compact, well-illustrated book. To receive a copy, ask for Catalog N-33-163(1).

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), March, 1943, Vol 87, No. 3. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

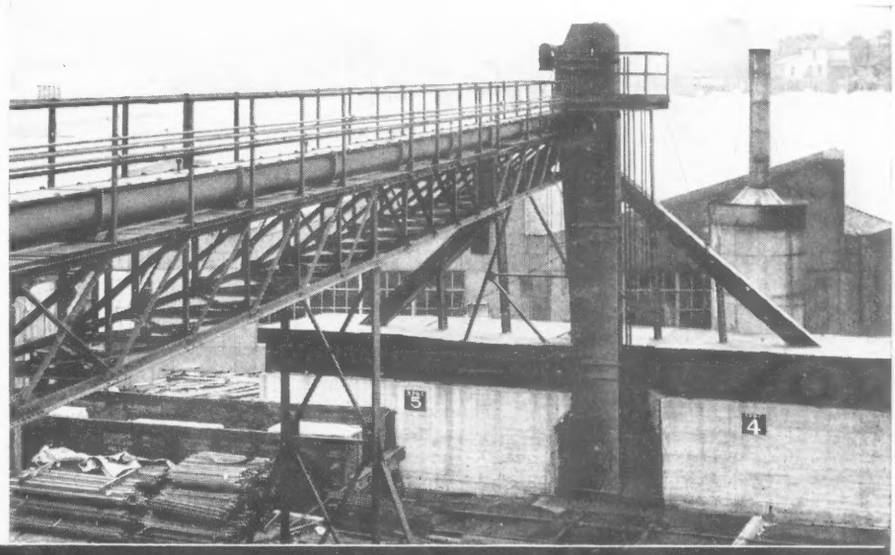
Mechanical Coal Handling AIDS WAR EFFORT!

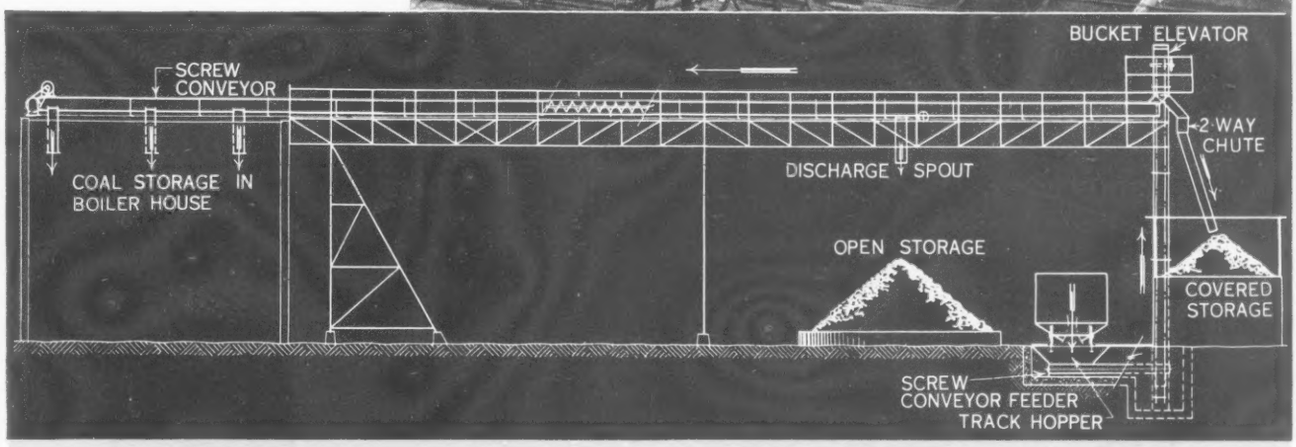
● To conserve man power, speed handling and eliminate a dust nuisance, a midwestern truck body plant recently installed this Link-Belt Coal Handling System. With orders for large numbers of defense truck bodies on hand, speedy production necessitated plant modernization in several aspects including the coal handling. Hand trucking from open storage piles was slow, costly and wasteful, aside from creating a dust nuisance. Mechanical handling with Link-Belt equipment is a major contribution to efficiency, economy and speed.

LINK-BELT COMPANY

Chicago, Philadelphia, Indianapolis, Atlanta, San Francisco, Dallas, Toronto. Offices in principal cities. 8780

This Link-Belt coal handling system consists of track dump hopper, screw conveyor feeder and bucket elevator which delivers coal to outside covered storage bins by means of a two-way chute, or to overhead screw conveyor for direct transfer to closed storage bins in boiler house. Open pile storage can also be arranged by discharging from screw conveyor at point indicated on diagram. All outside storage is readily reclaimed to bucket elevator.





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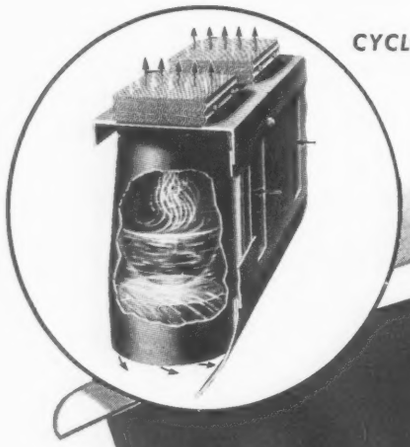
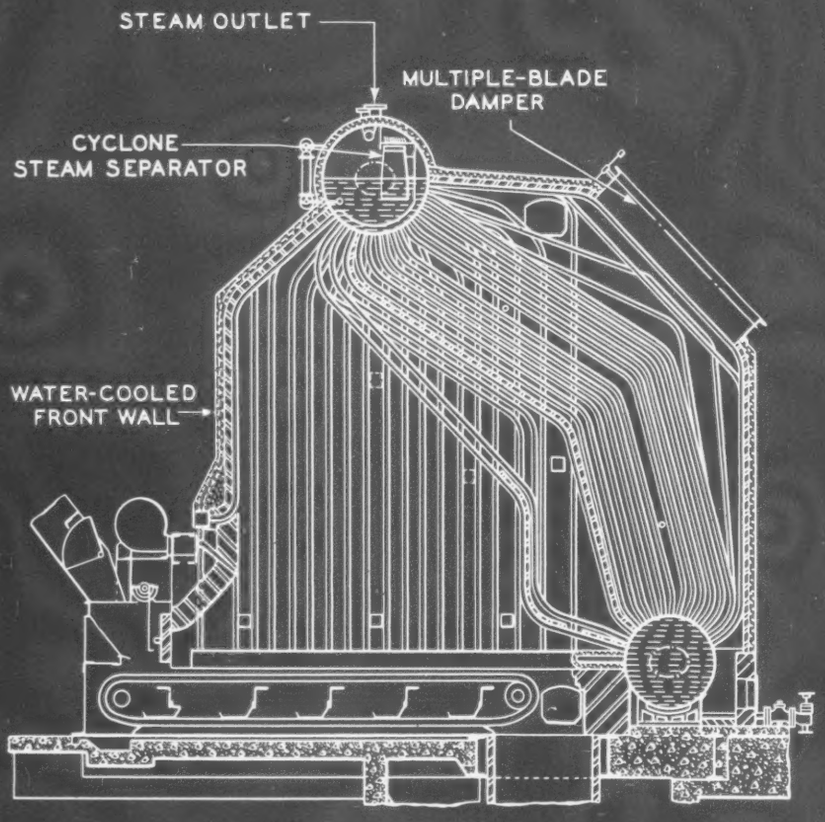
. . . Coal And Ashes Handling Equipment

CONVEYORS • ELEVATORS • SKIP HOISTS • CRUSHERS • LARRIES • SCREENS

for SIMPLIFIED OPERATION



CYCLONE STEAM SEPARATOR



SECTIONAL ELEVATION

THE BABCOCK & WILCOX COMPANY

BABCOCK

in SMALLER PLANTS —

B&W INTEGRAL FURNACE BOILERS

TRADE MARK REG. U.S. PAT. OFF

CLASSES 9, 12 & 15

DRY CLEAN STEAM is obtained over a wide range of operating conditions by the use of B&W Cyclone Steam Separators, used heretofore only on larger B&W boilers where extreme purity of steam is desired.

STEADY WATER LEVEL and more nearly correct indication in the gage glass are assured by the Cyclone Steam Separators, which provide steam-free water in the drum and downtake tubes, and minimize water-level variations caused by load changes.

LESS BLOWDOWN. The high boiler-water concentrations permitted by Cyclone Steam Separators result in less blowdown than is required by conventional-type boilers in similar service. Draining and blowdown are effected through one blowdown connection.

EFFECTIVE SOOT BLOWING. The boiler tubes, arranged with straight lanes between the rows, are well adapted to cleaning by means of soot blowers. Two elements do the job effectively.

EASY INSPECTION AND CLEANING. All pressure parts are readily accessible for inspection and cleaning. All the header handholes are accessible from outside the boiler. The steam drum internal fittings are easily removed when necessary. The steel casing facilitates good housekeeping.

To these advantages add reduced costs of fuel and maintenance, and economical construction.

For complete information about the Babcock & Wilcox Integral-Furnace Boiler, write for Bulletin G-34A. G-219 T

85 LIBERTY STREET, NEW YORK

& WILCOX

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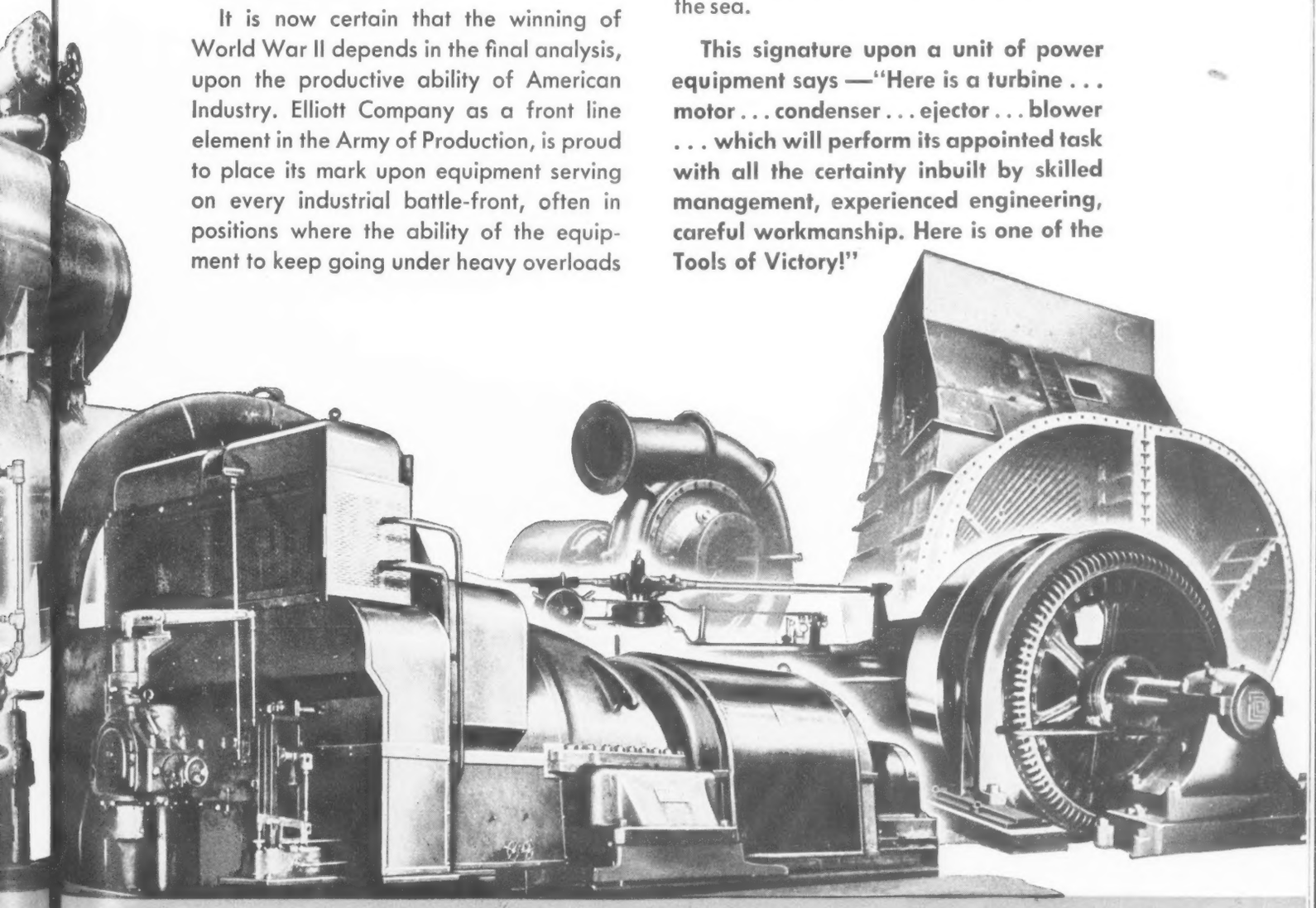
ELLIOTT

AMERICAN INDUSTRY *at its best!*

This is a day of symbols, with the "V" for VICTORY dominant. And the power behind the Victory symbol is supplied by the symbols of American Industry . . . such as the "E" monogram of ELLIOTT COMPANY.

It is now certain that the winning of World War II depends in the final analysis, upon the productive ability of American Industry. Elliott Company as a front line element in the Army of Production, is proud to place its mark upon equipment serving on every industrial battle-front, often in positions where the ability of the equipment to keep going under heavy overloads and the stress of extreme conditions, is vital to the continuance of essential production. This monogram also marks certain equipment even now in service with our armed forces—on land and sea and even beneath the sea.

This signature upon a unit of power equipment says —"Here is a turbine . . . motor . . . condenser . . . ejector . . . blower . . . which will perform its appointed task with all the certainty inbuilt by skilled management, experienced engineering, careful workmanship. Here is one of the Tools of Victory!"



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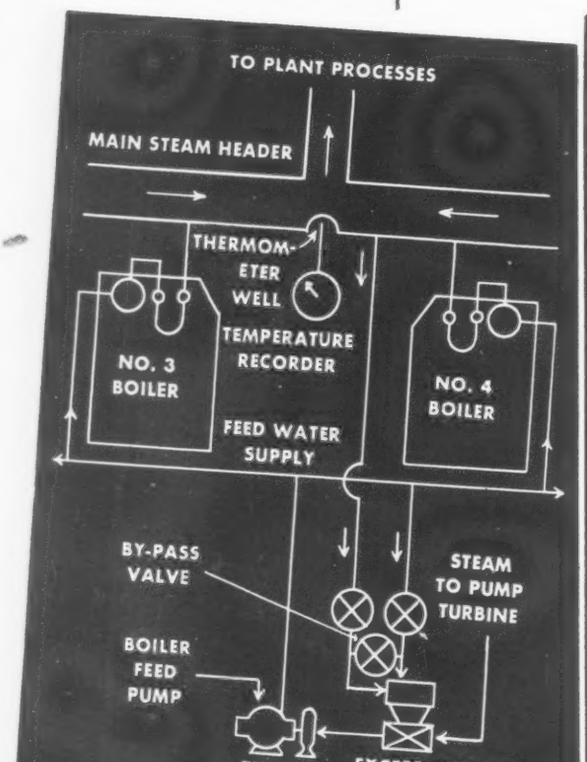
NON-RETURN VALVES • LAGONDA-LIBERTY TUBE CLEANERS

Two heads can spot trouble better than one!



Hall Service helps keep your plant at top efficiency

Now, when every pound of steam that can be produced is important, Hall Engineers can help you obtain conditions that assure maximum steam output. Even a fraction of an inch of scale in boilers or condensers causes considerable loss of efficiency.

Hall Service keeps boilers clean and on the job. It prevents time-wasting shutdowns. Call in a Hall Service Engineer. He'll help you meet increasing demands for more steam!

PROBLEM:

Steam header temperature suddenly drops 110° and stays there.

Correct diagnosis by Hall Service Engineer leads to quick solution by plant operator.

PLACE: A new steel mill boiler plant in the Pittsburgh area—Hall client.

TROUBLE: Temperature reading on main steam header suddenly dropped from 510° to 400° for no obvious reason. Operating pressure was 190 lbs.

POSSIBLE CAUSES:

1. INACCURATE RECORDING THERMOMETER. Thermometer was removed, checked and replaced by the plant engineer—but the total temperature drop remained the same.

2. CARRYOVER. Trouble reported to Hall Laboratories. Hall Service Engineer immediately investigated. His diagnosis indicated carryover was probably insufficient to cause temperature drop. Suggested that plant personnel look elsewhere for the trouble while he made a steam quality test to prove the accuracy of his diagnosis.

TROUBLE LOCATED: While conductivity equipment was being set up for the steam quality test, the plant staff continued the search, discovered a cracked valve in the by-pass line between the steam and water lines connected to a bellows-type excess pressure regulator. The by-pass line was used when the differential pressure of the two lines was high, in order to relieve the pressure and avoid cracking the regulator bellows. (See diagram). The cracked valve admitted feed water to the steam side of the regulator. Thermometer well and regulator tap on steam header were in such a position that feed water, leaking into the steam header, was impinging on thermometer.

TROUBLE CORRECTED: Valve on by-pass line replaced and closed. Total steam temperature immediately rose to 510° and stayed there.

PROOF OF CORRECT DIAGNOSIS: A final check with the conductivity equipment showed steam to be of very good quality.

HALL LABORATORIES, INC. • 300 ROSS STREET • PITTSBURGH, PA.

HALL SYSTEM *of Boiler Water Conditioning*

4 WAYS BETTER..

TEXROPE* SUPER-7

1 **50% STRONGER CORDS!** Sensational new Flexon process makes cords 50% stronger than even those in former great Texrope belts.

2 **20% MORE CORDS!** Count them! You get 20% more of these tough, extra pulling power cords in every Texrope Super-7.

3 **INCREASED LIFE!** Cords float on amazing cool-running cushion rubber that absorbs shock . . . actually increases belt life phenomenally.

4 **EXTRA PROTECTION!** Exclusive duplex-sealed cover protects pulling cords against dirt, grit, moisture, and other adverse elements.

SINCE Texrope V-belts revolutionized power transmission sixteen years ago, they have steadily been "tops" among belt users. But here's the NEW Texrope Super-7 V-belt that's even better — 4 WAYS BETTER!

To the war-busy manufacturer who must get maximum efficiency out of his machines today, this is the V-belt that can help him, with . . .

50% stronger pulling cords!

20% more cords!

Duplex-sealed cover for extra protection against dirt, moisture!

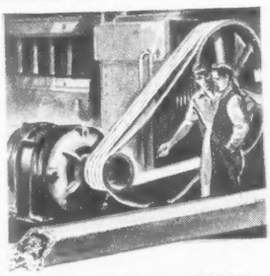
Cool-running cushion rubber section for increased life!

What's more — these are in *addition* to the regular features that have long made Texrope V-belts first choice with plant men everywhere.

Such features as — true V-shape for greatest groove-grip action . . . matched "sets" of belts that pull together...smooth, slipless, silent operation . . . backed by Allis-Chalmers engineering cooperation that assures you get the *right* belts for *your* job.

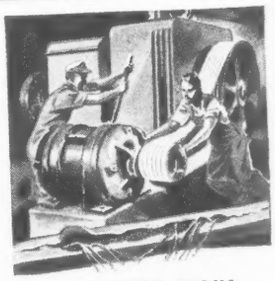
For complete information, call your Texrope dealer, or the Allis-Chalmers district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin.

A 1475



LOOK OUT FOR DANGER

in belts with stiff, unpliable cords! Such belts *look* strong . . . but actually they buckle over sheaves, build up excessive heat that attacks pulling cords. Result: Belt failure far sooner than you expect it.

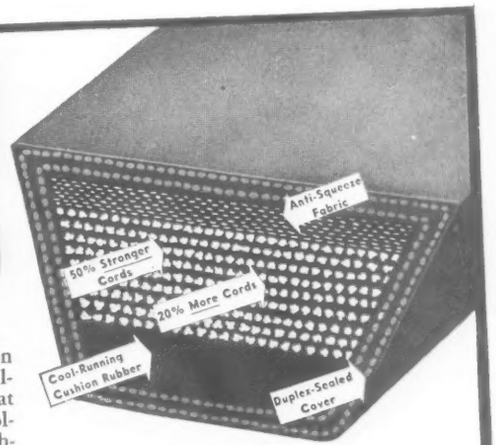


WARNING SIGN!

Sagging, slipping belts mean too much stretch not backed up by balanced cord strength. Motor must be pulled back often to take up slack. Result: When stretch limit is reached belt breaks under tension.

SUPER-7 TEXROPE BELTS

are made by amazing Flexon process that *combines* flexibility with low stretch . . . great strength. Cords float on cool-running, shock absorbing cushion rubber. Result: *true* strength . . . *true* pulling power . . . *true* endurance.



Available in All Sizes
½ hp to 2000 hp

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the cooperative research and design genius of *two* great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers.

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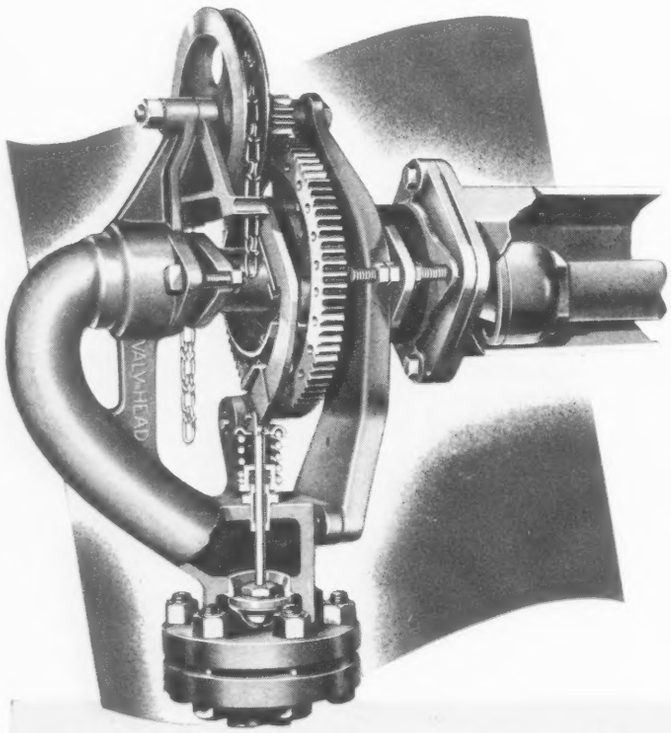
UNCHALLENGED

In any group of men or products, one always stands out from the rest — one which has superiority so marked that it is not seriously questioned or challenged. • Diamond G9B Soot Blowers and Diamond Bi-Color Water Gauges have this kind of superiority — in design, construction and records of performance.

DIAMOND G9B Soot Blowers

Developed through long study and a wealth of experience in boiler cleaning, the Diamond G9B Soot Blower has a universally acknowledged position of leadership among soot blowers. More than 80% of the soot blowers in modern power plants are Diamond.



IMPORTANT FEATURES ARE:

SERVICE POLICY—Every installation of Diamond Soot Blowers in water tube boilers is regularly inspected and adjusted, unsolicited and without charge. Reports show this exclusive Diamond Service annually saves many thousands of dollars for users.

FLEXIBLE ELEMENT CONNECTION—Makes the element self-adjusting to movement of boiler tubes or boiler walls.

LONGITUDINAL ADJUSTMENT OF ELEMENT—Easy external means of adjusting nozzle registration with tube spaces without demounting head.

CLOCKWISE OR COUNTER CLOCKWISE ROTATION—Heads are furnished for either rotation so that it is always possible to blow with the draft.

REDUCED PRESSURE BLOWING—Diamond cam and trigger make it possible to blow very lightly and gently against baffles, etc., that might be injured by full pressure blowing.

360° BLOWING ARC—Provided by simple cam and trigger arrangement . . . also easily installed on existing heads when necessitated by changes in boiler baffling.

Ask for Bulletin No. 884-A.

DIAMOND POWER

SUPERIORITY

DIAMOND BI-COLOR WATER GAUGES

STEAM SHOWS RED
WATER SHOWS GREEN

Wherever the boiler drum is high and the water gauge difficult to see—wherever steam pressures are high and water levels sharply critical, an overwhelming number of engineers prefer the Diamond Bi-Color Water Gauge. It is the acknowledged champion of water gauges.

Using the simple optical principle of the difference in refraction (bending) of light rays passing through water and through steam, the Bi-Color shows steam as red . . . water as green. As the optical law is invariable, the contrasting image is a completely reliable indication of exact water level at all times.

The image is so sharp and clear it can be mirrored to the instrument panel from any height—through as many as three grating floors without the slightest confusion.

The Bi-Color is the top ranking water gauge—the "best of breed."

Write for Bulletin No. 917-A.

SPECIALTY CORP. DETROIT, MICHIGAN
DIAMOND SPECIALTY LIMITED • WINDSOR, ONTARIO

41 YEARS *of*

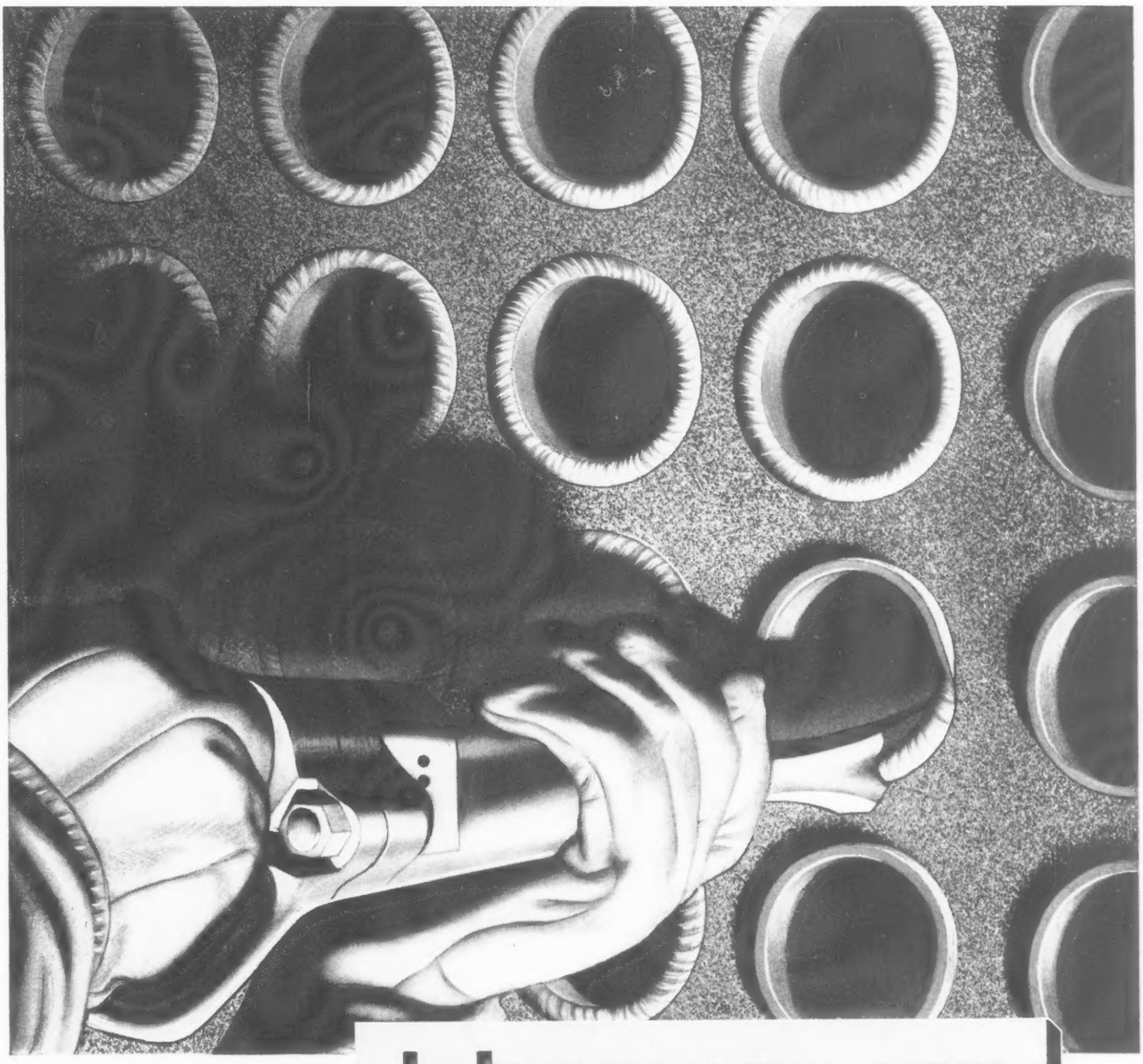
Superheater Experience

1901	First extended surface superheaters in U. S. A.—single piece castings.
1902	Separately fired superheaters — brick settings.
1903	First composite construction—steel tubing covered with cast iron rings; shrunk on.
1905	Portable superheaters — cast iron casings; oil, gas, or coal fired.
1906	Waste heat superheaters.
1907	Bare tube superheaters of seamless steel tubing.
1907	Marine superheaters.
1919	Radiant superheaters — in boiler furnace walls.
1921	Combination superheaters — convection and radiant sections in series.
1940	Separately-fired combination superheaters —for twin furnace steam generators.

The experience of Foster Wheeler in the field of steam superheaters is outstanding. For more than forty years it has averaged better than a superheater a day for every day in every year. It has pioneered in the most important developments and has furnished equipment to countries throughout the world. Temperatures exceed 1000 deg. F.

Foster Wheeler Corporation, 165 Broadway, New York, N. Y.

FOSTER WHEELER



J&L SEAMLESS STEEL BOILER TUBES

form easier, roll in faster and then "stay put"— no welds, no weak spots.

J&L PIPE

J&L TUBULAR PRODUCTS

Seamless Steel Boiler Tubes
Large O.D. Pipe, Welded and Seamless
Permalined (cement-lined) Pipe
Welded and Seamless Standard Pipe

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS • PITTSBURGH, PENNSYLVANIA

ANNOUNCING!

the greatest Motor Improvement in years!

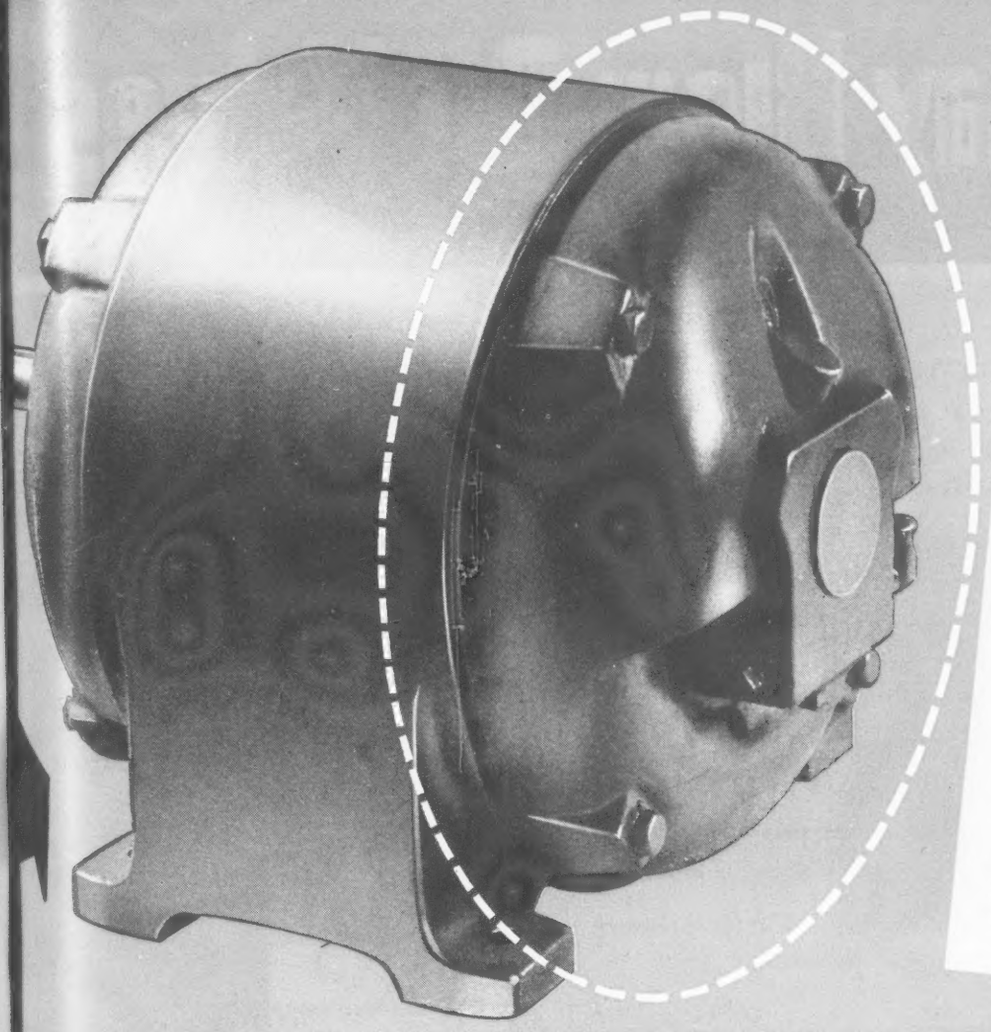
New Design . . . New Construction Give You New Protection You've Never Had Before In A General Purpose Motor!

OUTSIDE . . . INSIDE . . . from bearing to bearing . . . from frame to shaft—Allis-Chalmers now gives you a NEW motor more completely protected — more able to stand the terrific abuse today's production schedules demand.

All the experience of building motors for over fifty years has been concentrated in the development of this advanced product. Specially designed to give your motors "all-around" protection, the new "Safety-Circle" is a wide, solid rib — integrally

A-C ALLIS-CHALMERS MILWAUKEE

ALLIS-CHALMERS LO-MAINTENANCE



SEE HOW "Safety Circle" GIVES YOU PROTECTED ENCLOSURE OF ALL VITAL PARTS

Look at the "broken-circle" design of other motors with exposed undercarriage and incomplete protection. Compare this to "Safety-Circle" construction that guarantees *all-around protection* of vital parts.

Acting as an anchored shock absorber, it gives the entire structure of the motor and all its parts high resistance to blows, knocks, falling objects — keeps your motor in factory-fresh condition for its entire life under normal operating conditions.

To foremen, superintendents, and maintenance men it means more service and smoother operation with less maintenance and lower costs — *more motor for your money* in the Allis-Chalmers way.

NEW ALLIS-CHALMERS LO-MAINTENANCE MOTOR WITH ALL-AROUND "Safety Circle" PROTECTION*

cast as part of the frame — which forms an unbroken circle of protection around the stator. One-piece cast frame and cast end-brackets guard against exterior knocks and abuse.

A more liberal use of electrical materials makes this motor internally and electrically stronger because current and magnetic densities are less extreme. Additional cross strength has been built into the distortionless stator. Rotor is keyed to the shaft for strength, and its outer surface is turned to assure air-gap accuracy and uniformity.

Shorter, stronger bearing design delivers smooth performance with full-flow lubrication and easier maintenance. New machining and production methods make all parts uniform and interchangeable.

Other Lo-Maintenance features of this outstanding NEW Motor are oil drains at the bottom of the bearing box for easy flushing, removable end-brackets and large conduit box for handy wiring.

Write Allis-Chalmers, Milwaukee, Wisconsin, for Bulletin No. B-6210, and test this NEW Motor's design and construction against your own experience! See how it fits your needs . . . then call the engineer in the district office near you!

*Don't confuse this NEW motor with higher-priced motors for so-called special purposes. All the extra advantages of this standard motor are yours *at no extra cost!* A 1484

MOTOR WITH "Safety Circle" PROTECTION

52 Yarway Blow-Off Valves

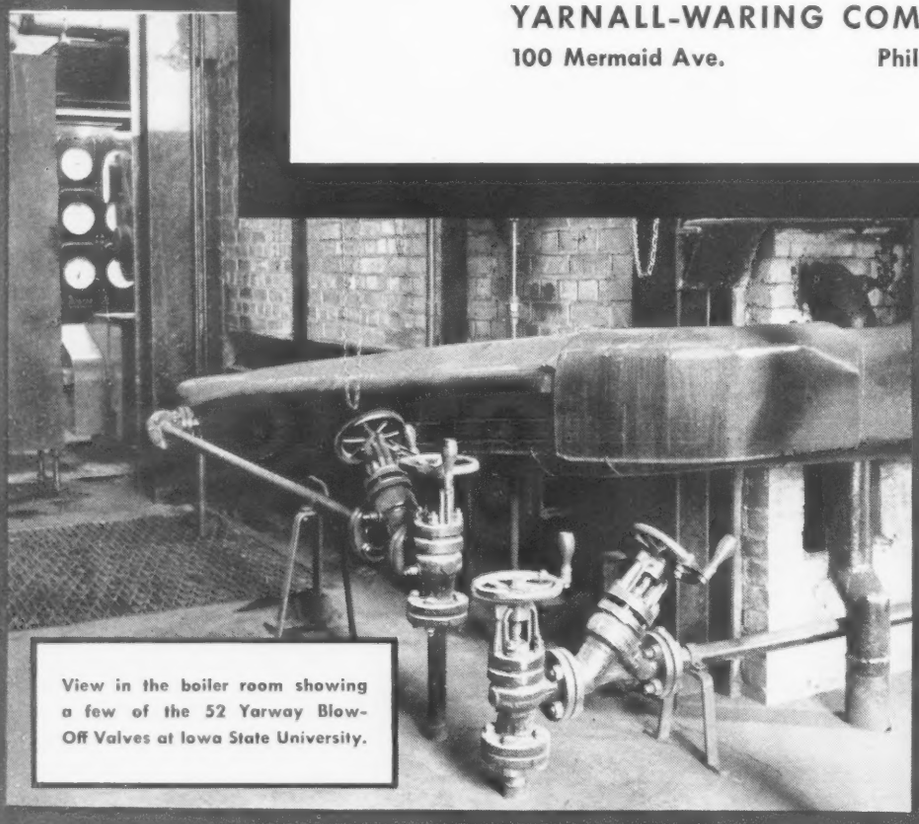
TWENTY YEARS of experience with Yarway Blow-Off Valves at the State University of Iowa has convinced their chief engineer that "Yarway Valves are the best blow-off valves on the market."

He states further—"This plant is 100% Yarway-equipped. The 52 valves have given us long and satisfactory service at a maintenance cost so low it can't be measured. And for years these valves have been operated three times every 24 hours."

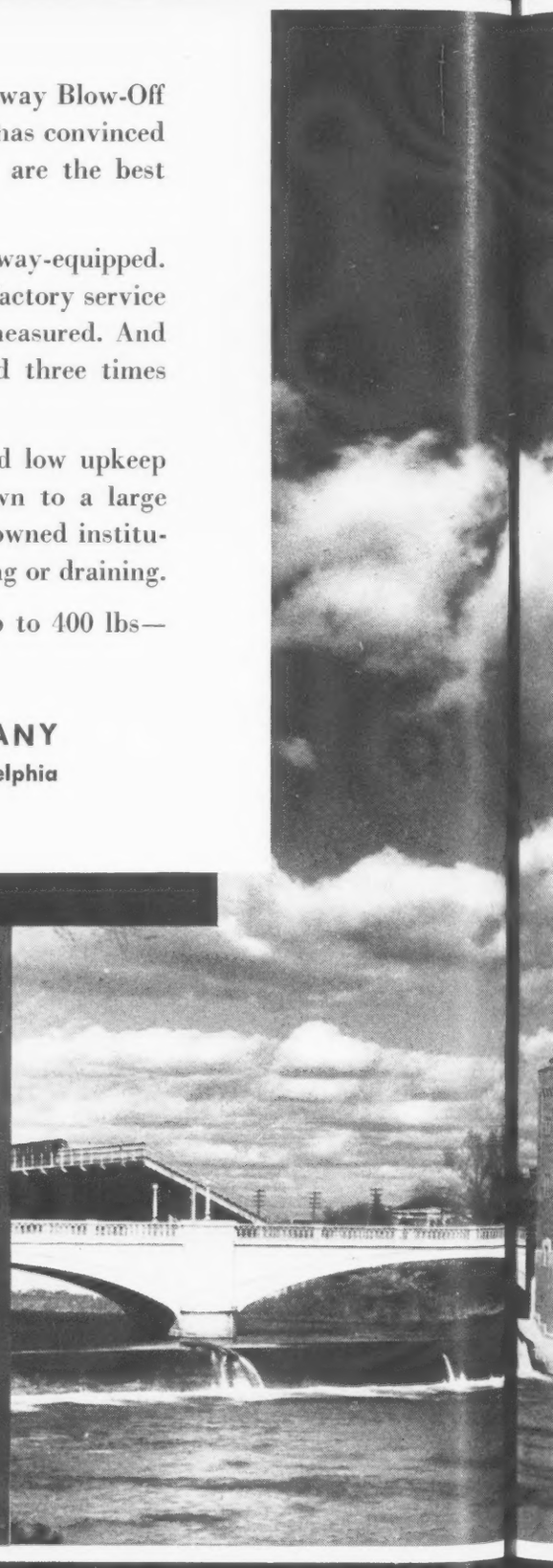
The positive dependability, long life and low upkeep of Yarway Blow-Off Valves are well-known to a large majority of important private and public-owned institutions. They are equally suitable for blowing or draining.

Ask for Catalog No. 421 for pressure up to 400 lbs—No. 430 for higher pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia



View in the boiler room showing a few of the 52 Yarway Blow-Off Valves at Iowa State University.

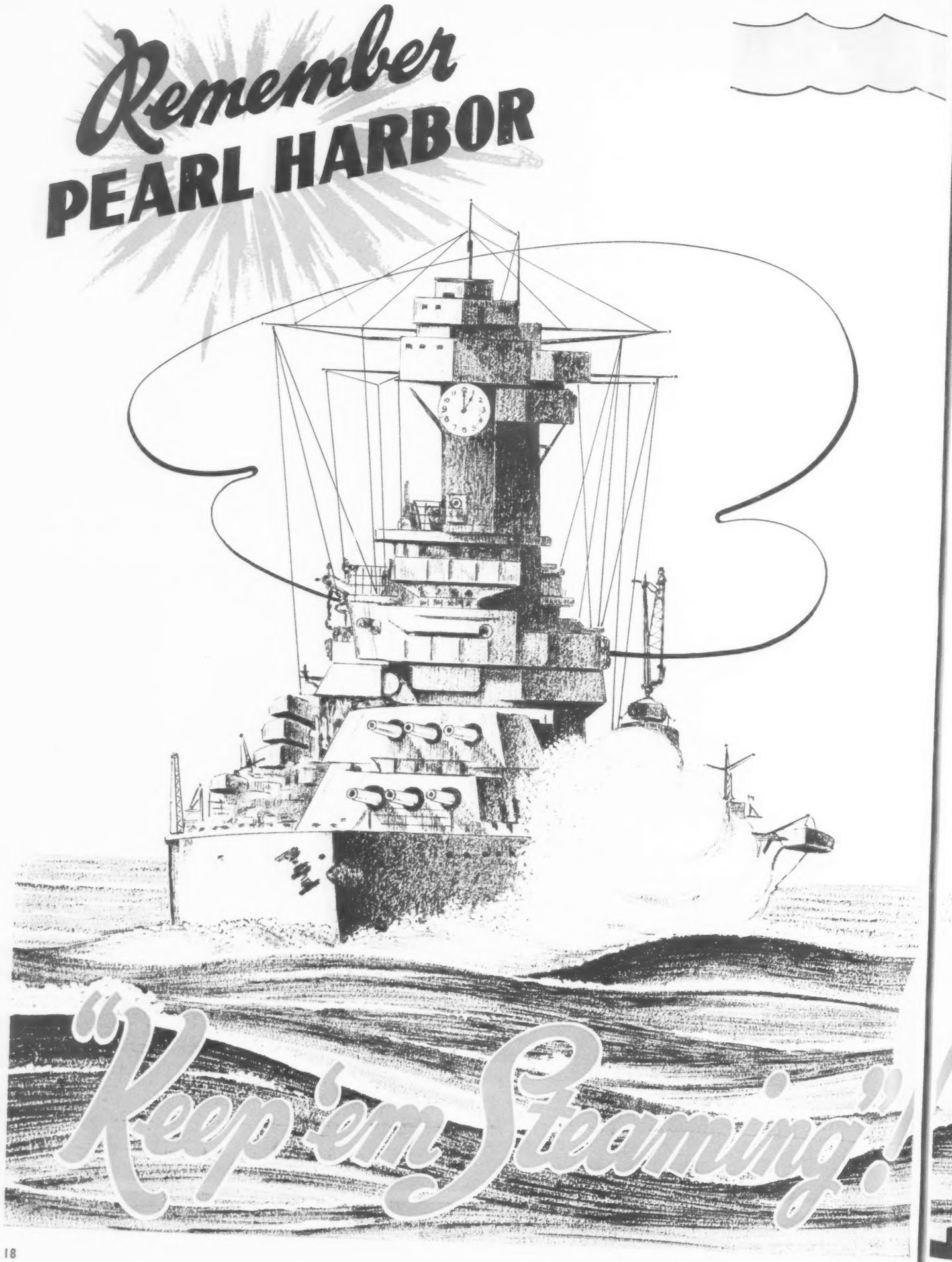


YARWAY

at Iowa State University

Rising majestically in surroundings of great natural appeal, the power plant of the State University of Iowa presents a picture of beauty as well as efficiency.

BLOW-OFF VALVES


Remember
PEARL HARBOR
"Keep 'em Steaming!"

LUNKENHEIMER VALVES

ARE HELPING TO BUILD BATTLESHIPS

ESTABLISHED 1862

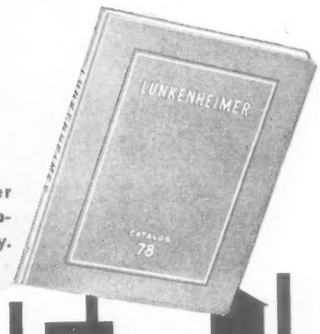
THE LUNKENHEIMER CO.

"QUALITY"

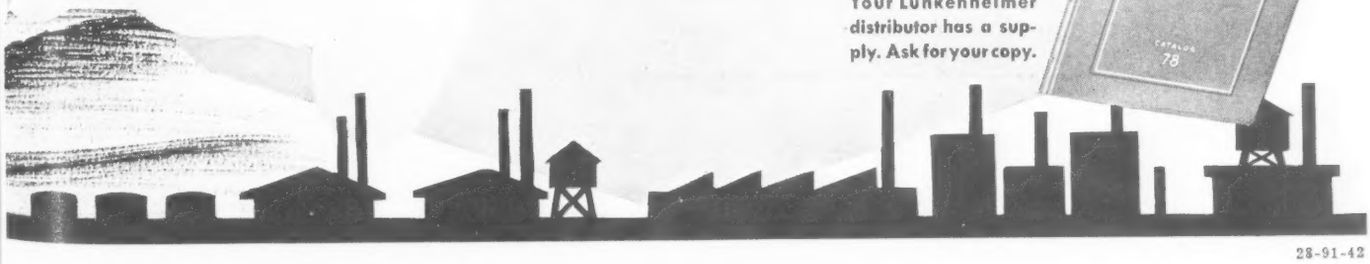
CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

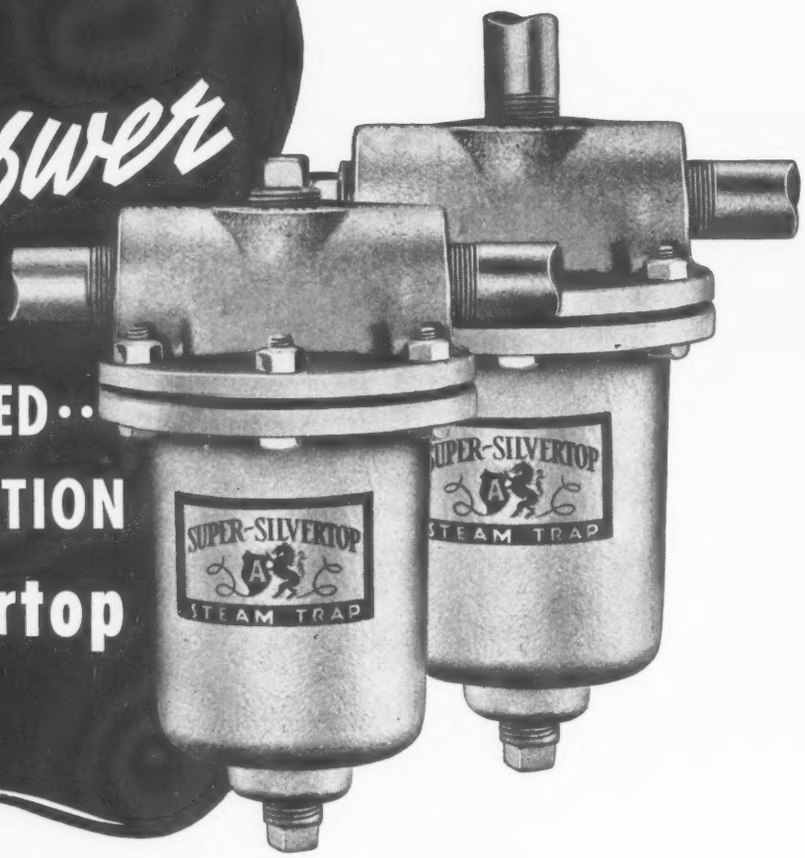


Your Lunkenheimer distributor has a supply. Ask for your copy.



28-91-42

One Answer TO DEMANDS FOR MORE SPEED.. MORE PRODUCTION Super-Silvertop



SPEED YOUR SELECTION of proper size and type of steam trap by referring to the book "How To Choose A Steam Trap." If your copy of this helpful book is missing, write for another—it's free.

SPEED INSTALLATION by using Anderson inverted bucket steam traps. No extra fittings to cut, thread and fit—saves as much as 60 minutes installation time per trap—Super-Silvertop is connected with only two threaded joints and either straight-in-line or as an elbow. See illustration above.

MORE PRODUCTION per day on process work with Super-Silvertop because air and condensate are removed from the system quickly—and constantly. This removal is mechanical, not dependent on temperature of the entrained air or moisture. This removal insures system is always full of hot, dry steam—that's why you get more production, more batches per day.

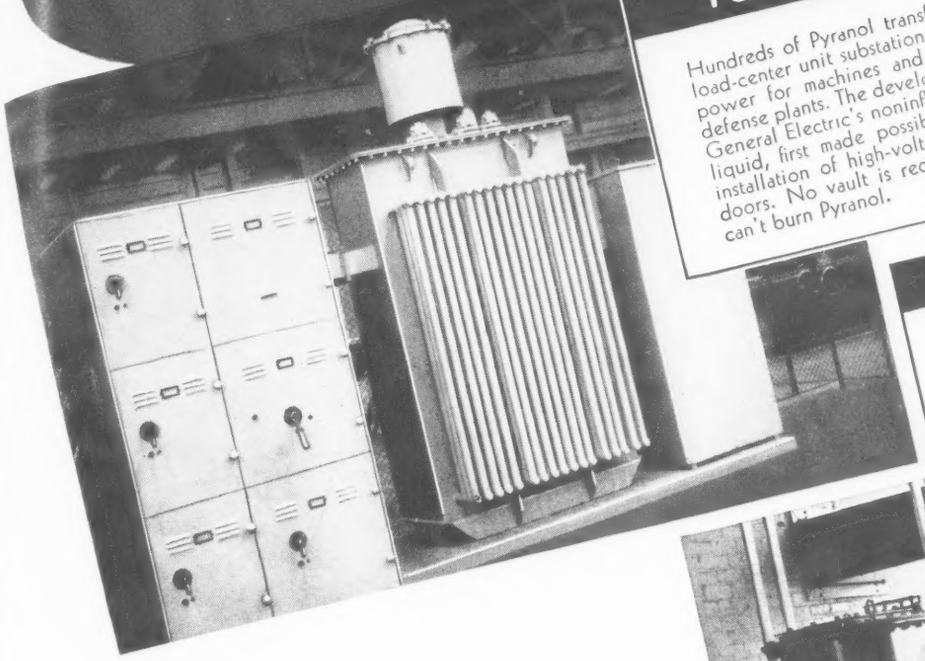
LESS MAINTENANCE time is needed with Super-Silvertop traps. They have long-life valve and seat—large, smooth, drilled passages (not cored) that seldom clog with dirt and scale—guided bucket for positive valve closing. No thermostatic elements to replace.

Send for your free copy of "How To Choose A Steam Trap"—start with this first step toward more speed and more production in meeting today's urgent demands.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland, Ohio

Super-Silvertop STEAM TRAPS

Why the Rapid Growth in the Use of PYRANOL TRANSFORMERS?



FOR NEW PLANTS

Hundreds of Pyranol transformers—in G-E load-center unit substations—are supplying power for machines and lighting in new defense plants. The development of Pyranol, General Electric's noninflammable insulating liquid, first made possible the economical installation of high-voltage transformers indoors. No vault is required, because you can't burn Pyranol.

FOR PLANT EXPANSION

When this plant needed more power, it installed these Pyranol transformers indoors. They bring primary power close to the load. Long runs of heavy secondaries are eliminated, effecting major savings in copper. For plants that must have more power for stepped-up production, Pyranol transformers provide the quick, safe method of increasing transformer capacity.

HERE'S WHY

PYRANOL* transformers can be installed indoors—right at load centers—without a fireproof vault. This speeds installation and saves materials, particularly copper.

Pyranol is noninflammable, and no Pyranol transformer in the 10 years since Pyranol was introduced has burned, or contributed to a fire.

Pyranol transformers require little, if any, maintenance. Pyranol is nonoxidizing and nonsludging. The pressure-tight tank protects vital parts of the transformers against moisture, dirt, dust, and sabotage. Immersion of the transformer interior in the liquid Pyranol prevents drying and cracking of the winding insulation.

Pyranol transformers have high dielectric strength, both at normal frequency and impulse, which means greater ability to withstand voltage surges that originate from switching operations or lightning.

The heat-storage capacity inherent in liquid-filled transformers makes Pyranol units ideal for sustained emergency overloads.

The reliability of Pyranol transformers has been proved by 10 years of service. Total installed capacity of Pyranol transformers is more than 2,000,000 kva.

For complete information on Pyranol transformers for your requirements, consult your G-E representative. Or, write for Bulletin GEA-2048C. *General Electric, Schenectady, N. Y.*

*Reg. U.S. Pat. Off.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

402-40-5100

TEXACO

REG. T. M.

TEXACO

Operating Freely

YOU CAN RUN YOUR DIESELS longer between inspections and overhauls, yet be assured of free rings, full power and substantial fuel savings, when you use *Texaco Algol or Ursa Oils.*

Highly resistant to the formation of gum, sludge and hard carbon, *Texaco Algol and Ursa Oils* keep rings, grooves, valves and ports CLEAN. The little carbon that may form is soft and fluffy . . . blows away with the exhaust.

Because of the benefits secured by users everywhere—

More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

The outstanding performance that has made Texaco FIRST in the stationary Diesel field, has made it FIRST in the fields listed in the panel.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

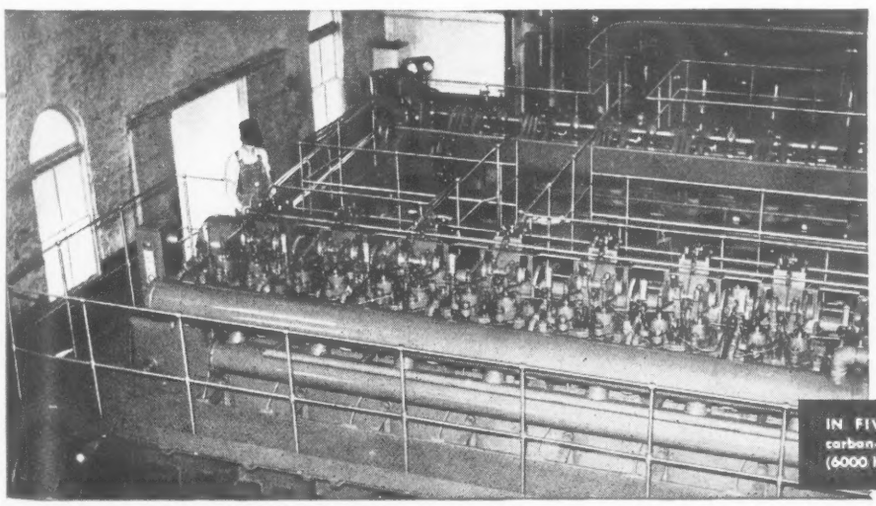
★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.



IN FIVE DIESELS, totaling 2260 hp., in Perry, Okla. power plant, carbon-free pistons and rings, cleaner crankcases, lower oil consumption (6000 hp. hrs. per gal.) are direct results of changing to *Texaco Ursa Oils.*

FOR YOUR ENJOYMENT
Two Great Radio Programs

FRED ALLEN every Sunday night. See your local newspaper for time and station.

METROPOLITAN OPERA. Complete broadcasts of great operas every Saturday. See your local newspaper for time and station.

★

DIESEL OPERATION MANUAL. 96 pages of charts, diagrams, photographs and text, plus new section on special purpose Diesel lubricants and complete Diesel lubrication chart. Yours for the asking.

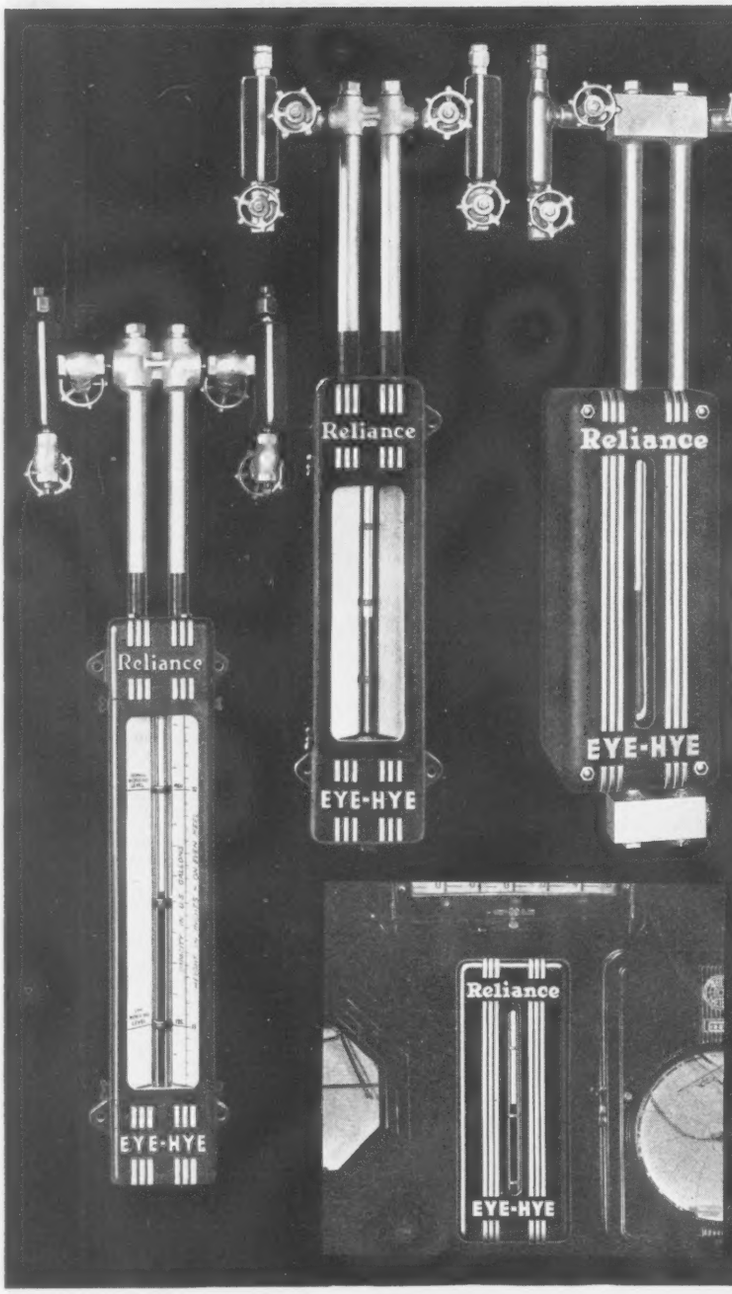
★

RETURN METAL DRUMS PROMPTLY . . . thus helping to make present supply meet industry's needs and releasing metal for War Needs.

Lubricants and Fuels

FOR POWER PLANT EQUIPMENT

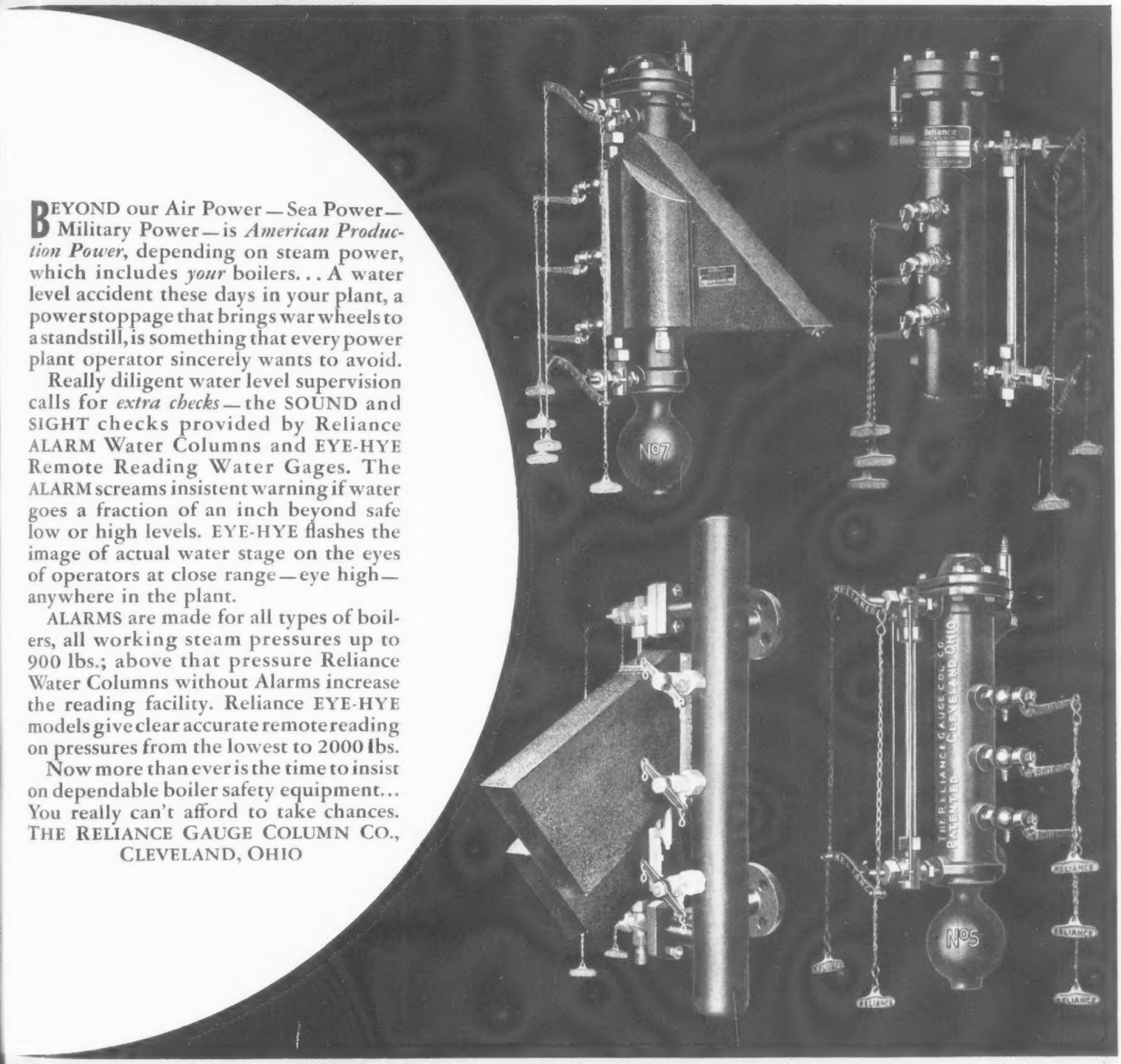
Power Accidents *Now*



Take no chances... guard your boilers with these proved Reliance Devices. ...They're already busy watching water levels in thousands of War Industry power plants....

Reliance

Are Inexcusable...



BEYOND our Air Power—Sea Power—Military Power—is *American Production Power*, depending on steam power, which includes *your* boilers... A water level accident these days in your plant, a power stoppage that brings war wheels to a standstill, is something that every power plant operator sincerely wants to avoid.

Really diligent water level supervision calls for *extra checks*—the SOUND and SIGHT checks provided by Reliance ALARM Water Columns and EYE-HYE Remote Reading Water Gages. The ALARM screams insistent warning if water goes a fraction of an inch beyond safe low or high levels. EYE-HYE flashes the image of actual water stage on the eyes of operators at close range—eye high—anywhere in the plant.

ALARMS are made for all types of boilers, all working steam pressures up to 900 lbs.; above that pressure Reliance Water Columns without Alarms increase the reading facility. Reliance EYE-HYE models give clear accurate remote reading on pressures from the lowest to 2000 lbs.

Now more than ever is the time to insist on dependable boiler safety equipment... You really can't afford to take chances.

THE RELIANCE GAUGE COLUMN CO.,
CLEVELAND, OHIO

BOILER SAFETY DEVICES

Look at the

Pioneers in inclined water walls...Pioneers in water-cooled stokers...Rely on the leader!

AS YOU set out to select modern firing equipment, note who it was that pioneered the introduction and major improvements of the multiple retort inclined underfeed stoker.

These same engineers originated stoker inclined side water walls. It is therefore only natural that they should be best qualified to develop and introduce the water-cooled stoker to fully satisfy demands for equipment which can burn the poorest or the highest grade coal with equal ease.

In *all* improvements, isn't it logical to expect the highest perfection from a 37 year experience devoted to coordinating stoker and furnace design into one increasingly efficient steam generating unit?

It is important to know all the facts! It is important to deal with the leader. Only so can you be assured of the utmost in equipment and service. Only so can your dollar be made to yield all that your power requirements demand. American Engineering Company, Aramingo Avenue, Philadelphia.

AMERICAN ENGINEERING

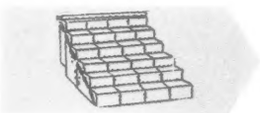
A-E-CO Taylor Stokers, Water Walls, Ash Hoppers, Hele-Shaw Fluid Power, Lo-Hed

Record!

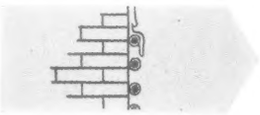
MILESTONES IN STOKER HISTORY

1937 "Noblo" Tuyere
Venturi-shaped passages provide self-limiting air flow, thus equalizing combustion rate over the entire stoker.

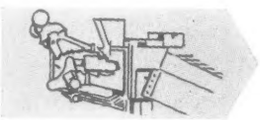
1934 Taylor Stoker, Water-Cooled
Burns *reliably* all grades of bituminous and semi-bituminous coal, of any analyses or ash fusion temperatures.



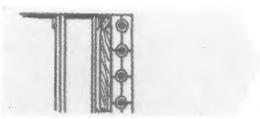
1930 Ducar Extension Grates
Refractory blocks provide exceptionally low maintenance with low sulphur coals.



1929 Slag Drip Feature
Slag drip feature of inclined side water walls causes molten slag to solidify; increases combustion rates.

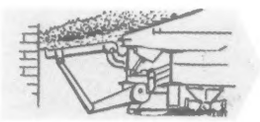


1929 Straight Line Drive
Straight rather than angular thrust on rams reduces wear and permits individual adjustment of secondary coal pushers.

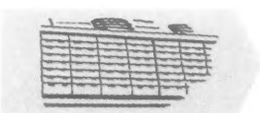


1926 Inclined Side Water Walls
Located at side of and immediately above stoker, provides cooling where most effective and where highly desirable.

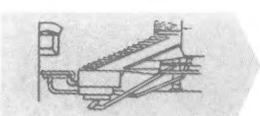
1919 Multiple Retort Hydraulic Stoker
Coal-feeding rams are actuated by oil under pressure. No crankshafts, power boxes, gear trains or shearing pins.



1915 Power Operated Dump Plates
Power Operated Dump Plates permit ash removal from furnace in a few seconds and without manual labor.



1913 Moving Overfeed Section
Moving Overfeed Section breaks up clinker formations and burns out remaining combustible in the coal.



1904 Taylor Multiple Retort Stoker
The Taylor Multiple Retort Stoker, the original inclined retort underfeed stoker, was introduced in this year.

Write today for **FREE** literature giving more detailed information about A-E-CO Taylor Stokers.

THE A-E-CO Taylor Stoker

A-E-CO Water Walls

COMPANY

Hoists, Marine Deck Auxiliaries

Sustained 2.1% Above

This Bailey Boiler Control Panel at the Broadway Pumping Station automatically operates a 50,000-lb. per hour capacity boiler at a sustained efficiency of 82.1%, which is 2.1% in excess of the boiler guarantee.

CITY OF TOLEDO
OHIO

DEPARTMENT OF PUBLIC SERVICE
DIVISION OF WATER
Offices - Erie & Orange Streets

Telephone
Main 1271

Broadway Pumping Station

Feb.19,1941

ROBERT W. FURMAN
Commissioner

Bailey Meter Co.
1050 Ivanhoe Rd.
Cleveland, Ohio
Attn: Mr.N.M.Barnett

Sub: Automatic Boiler Control

Dear Sir:

This letter is in answer to your recent request concerning the operation of the Bailey Control on our Taylor Underfeed, Stoker Fired, 50,000 lb. per hour B&W Stirling Boiler, installed in 1940.

The control equipment has proven satisfactory beyond all expectations. The unit has been operated at all times under full automatic control. The sustained operating efficiency over a period of 10 months is 82.10%. This compares with a guaranteed efficiency of approximately 80.0%, which indicates operation at very nearly maximum efficiency at all times.

This we believe, was made possible by controlling the fuel bed from the air flow-steam flow of the Bailey Boiler Meter, which maintains a proper fuel bed at all times and thus holds the excess air losses at a constant minimum.

You may feel free to call on us for recommendations at any time.

Very Truly Yours,

Geo. J. VanDorp
Superintendent

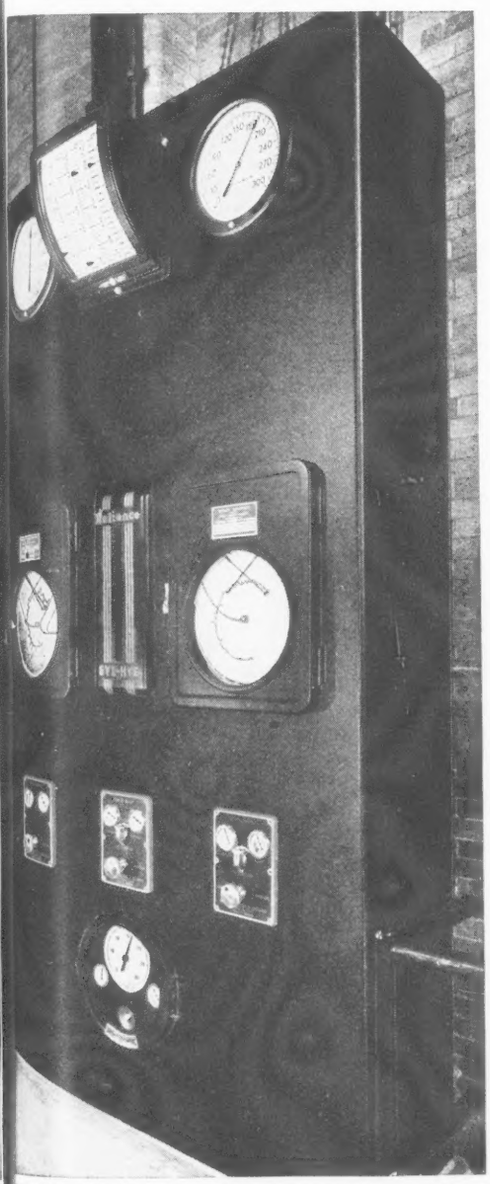
GJVD:FB

BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

Efficiency Runs Boiler Guarantee

. . . Station Superintendent Credits Performance to Automatic Readjustment Feature of Bailey Meter Control . . .



• At the Broadway Pumping Station of the City of Toledo, Ohio, Bailey Meter Control enables operators to continuously obtain efficiencies 2.1% in excess of the boiler guarantee. This installation on a 50,000-lb. per hour capacity, B & W Stirling Boiler, was made last year by the J. A. Young Co. of Toledo.

According to Mr. VanDorp's letter of February 19, 1941, sustained operating efficiency is made possible by controlling the fuel bed from the air flow—steam flow of the Bailey Boiler Meter which maintains a proper fuel bed at all times and thus holds the excess air losses at a constant minimum.

Automatic readjustment from the Bailey Boiler Meter is only one of the worthwhile extra values which Bailey Meter Control offers. Other features not found in ordinary control systems are:—

1. Control impulses are originated by standard Bailey Meters of proven accuracy.
2. Provision is made for addition of interlocks and other safety devices, in the control system.
3. Experience gained from the successful operation of thousands of boilers is built into each Bailey Control system.
4. Reliable Service for Bailey Meter Control is readily available through a staff of full-time Bailey engineers conveniently stationed in some 30 cities throughout the United States and Canada.

Bailey Meter Control is the power engineer's boiler room deputy —always on duty to save fuel, protect equipment and render reliable power service.

Ask for bulletin No. 102-C, which tells the full story of this complete combustion control system.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

A-72

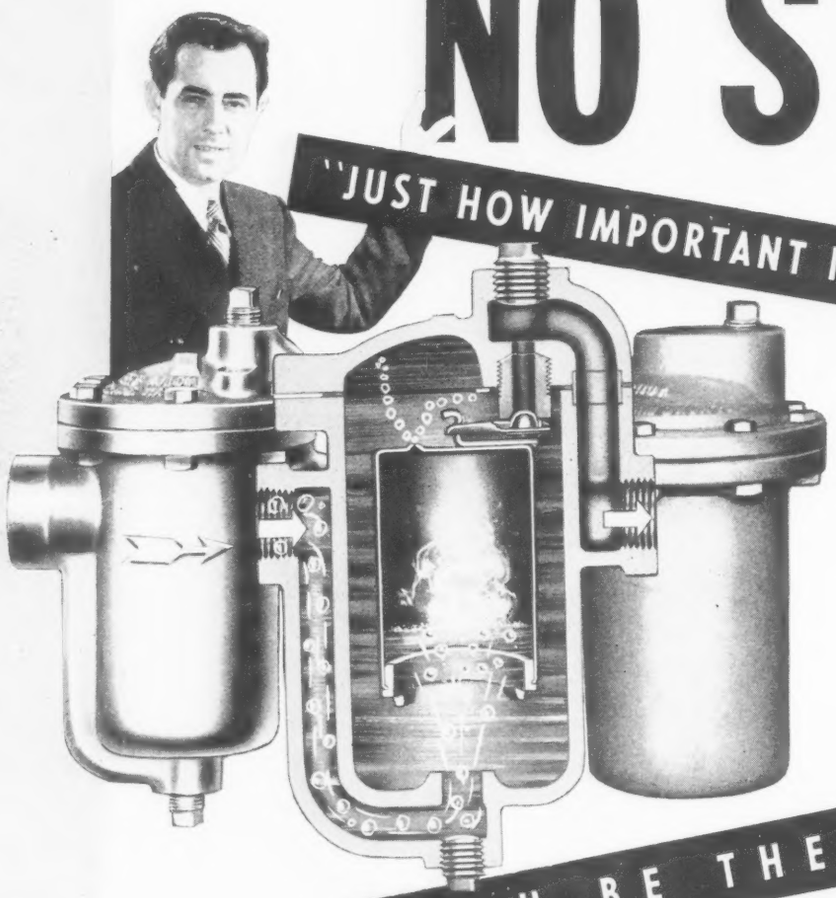
BAILEY METERS

The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

NO STEAM

"JUST HOW IMPORTANT IS THIS ADVANTAGE?"



• ARMSTRONG TRAPS are offered in side inlet styles for straight-thru pipe connections and bottom inlet styles for vertical pipe connections.

"YOU BE THE JUDGE"

TABLE A: Showing cost of various sized steam leaks at 100 pound pressure. (assuming steam costs 50 cents per 1000 lbs.)

Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
1/2"	835,000	$417.50	$5,010.00
3/8"	470,000	235.00	2,820.00
1/4"	210,000	105.00	1,260.00
1/8"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 pounds pressure, the waste is about 75% of the above figures; at 20 pounds, it is about 50%; and at 5 pounds, the loss is about 25%.)

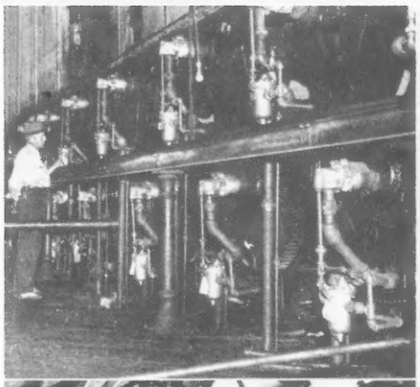
• The table indicates what it costs to have old, leaky traps or types of drainage devices that permit some leakage of live steam.

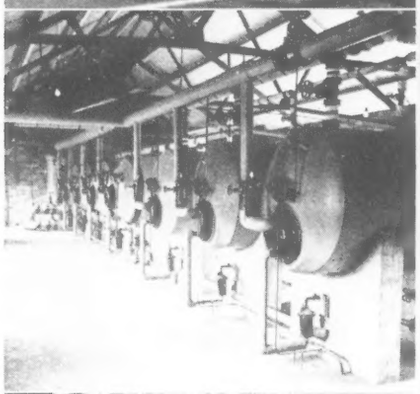
ARMSTRONG

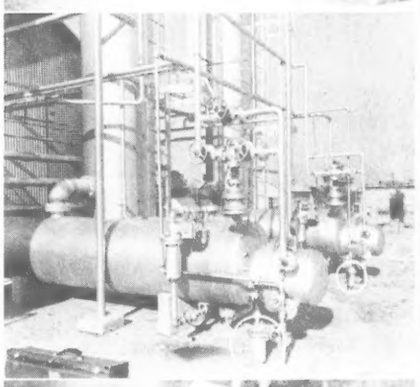
LEAKAGE

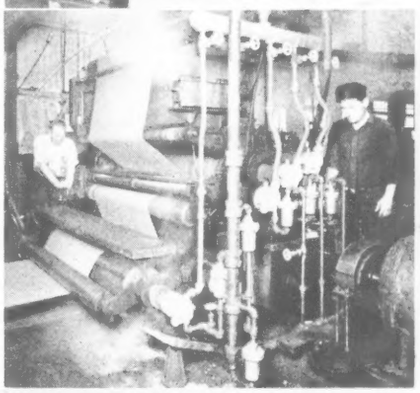
with

- LIGHT LOADS
- HEAVY LOADS
- FLUCTUATING LOADS
- INTERMITTENT LOADS
- NO LOAD









NOW is no time for industrial plants to be harassed by steam losses. Use of traps with leaky valves or traps of a type that won't close tight under variable load conditions constitutes a real menace to American industrial production capacity. How widespread such losses have become is indicated by the long list of installations where Armstrong traps have CUT FUEL COSTS . . . CUT BACK PRESSURE IN RETURN LINES . . . CUT LOAD ON BOILERS, in addition to raising temperatures and reducing maintenance expense.

Armstrong Steam Traps handle ANY load without loss of live steam—thanks to Armstrong's original development of the inverted bucket operating principle. Ability to give this kind of service over long period of time is a direct result of such quality construction features as all-stainless steel interior mechanism, free-floating valve, and special alloy valve parts. You get this kind of quality and performance in every Armstrong trap from the smallest up. Catalog on request.

ARMSTRONG MACHINE WORKS

812 Maple Street Three Rivers, Michigan

STEAM TRAPS

Is there a *Time bomb* in your power plant?

IT DOESN'T TAKE a bomb dropped from the sky to put your power plant out of commission . . .

Actually — scale, corrosion, carryover, embrittlement are time-bombs that work slowly, over many months. And they have the same ultimate disastrous effect.

Extra guards may protect your power plant from outside saboteurs. But what are you doing about protecting your plant against the inside fifth-column work of these feedwater dangers?

TIME IS SHORT! Your power plant is too important to you and to your country for you to take chances. Use Allis-Chalmers Feedwater Service . . . the complete service . . . and make sure that your boilers and prime movers are fully protected against all feedwater dangers!

Get the facts, today, about this proven service . . . not to be confused with chemical-selling systems . . . but a complete feedwater protection based on Allis-Chalmers 60 years experience making power plant equipment. Write Feedwater Division, Allis-Chalmers, Milwaukee, Wisconsin.

A 1476

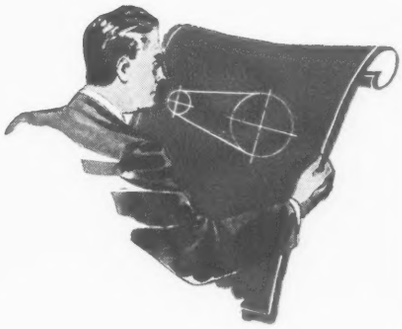
FIRST STEP — WHEN YOU SUBMIT your feedwater problems to us — is for a trained Allis-Chalmers Feedwater Service Engineer to visit your plant . . . analyze your conditions . . . take samples for preliminary study.

SAMPLES ARE THEN ANALYZED in the Allis-Chalmers laboratories . . . specific treatments suggested to prevent scale, corrosion, carryover, embrittlement, and all other feedwater ills, with provisions for changing conditions.

VITAL TO SUCCESS OF SERVICE— the Field Service Engineer in your territory makes frequent calls . . . inspects equipment . . . makes repeated water and steam tests . . . gives you complete feedwater protection at all times.

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN



MILLIONS IN RUBBER WASTE CAN BE SAVED IN INDUSTRY!

LET THE G. T. M. HELP YOU MAKE YOUR MECHANICAL RUBBER EQUIPMENT LAST LONGER

IN American factories millions of dollars worth of industrial rubber goods fail prematurely every year due to improper inspection and unintentional abuse.

This waste must stop—now that America's rubber life line is under attack. Every pound of rubber must work to the limit for victory.

Today it is essential to take the utmost care of any rubber product you now have in operation or in stock—*because replacement may be difficult in the months ahead, even on priorities!*

That is where the G. T. M.—Goodyear Technical Man—can be of greater help and service to you than ever before. In the past his expert skill in the correct application and installation of rubber has been responsible for countless performance records in all branches of industry.

By consulting the G. T. M. today, by following his recommendations on the proper handling of belting, hose and other rubber products, you can increase their service life measurably at a time when any increase in their life is critical.

He will be glad to go over your installations, to make suggestions and give you tips that will enable you to obtain all the service built into your rubber equipment—to prevent waste of America's most precious war material.

This service costs you nothing. The G. T. M. will be glad to call at your plant—to give you the benefit of his specialized training.

To call in the G. T. M., write Goodyear, Akron, Ohio or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

G.T.M

Serving on the Industrial Front to guard America's rubber supply

GOODYEAR

MECHANICAL GOODS

All 8 Resist Corrosion and provide lasting STRENGTH...

Offering unusual combinations of properties, INCO Nickel Alloys render valuable service in peace or war

plus **CORROSION RESISTANCE** . . . together with strength, hardness, toughness — **MONEL**

plus **EXTRA HARDNESS** . . . comparable to heat-treated alloy steel; heat-treatable, non-magnetic — **"K" MONEL**

plus **HEAT RESISTANCE** . . . with retention of high degree of strength. Resists oxidation, high corrosion resistance — **INCONEL**

plus **MACHINABILITY and EXTRA HARDNESS** . . . free cutting, heat-treatable, non-magnetic — **"KR" MONEL**

plus **RESILIENCE** . . . heat-treatable, for exceptional spring properties, magnetic, good electrical conductivity — **"Z" NICKEL**

plus **MACHINABILITY** . . . for high speed production in automatic screw machines — **"R" MONEL**

plus **HARDNESS in CASTINGS** . . . anti-seizing and non-galling — **"S" MONEL**

plus **NON-CONTAMINATION** . . . protects product purity; offers good electrical conductivity — **NICKEL**

Now, more than ever before, vital parts of equipment must *stand up in service.* Where such parts are subjected to stress, corrosion and wear it will pay to consider INCO Nickel Alloys.

Along with strength and resistance to corrosion, INCO Nickel Alloys combine varying degrees of resilience, heat resistance, extra hardness, non-magnetism and other useful properties.

Which of these metals to use for best results depends on the job to be done. Let INCO's technical division help you make the proper selection. Send us full particulars, or write for the new booklet, "*Individualized* INCO Nickel Alloys." Address:

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street New York, N.Y.

★ FIRST THINGS FIRST ★

With the Nation at war, supplies of Monel, Nickel and Nickel Alloys are needed for our armed forces. All efforts must now be aimed toward victory. In the meantime, The International Nickel Company will continue to issue information which it is believed will be of interest to metal users who are concerned with the war needs of today and the peace-time progress of the future.

SOME TYPICAL MECHANICAL PROPERTIES

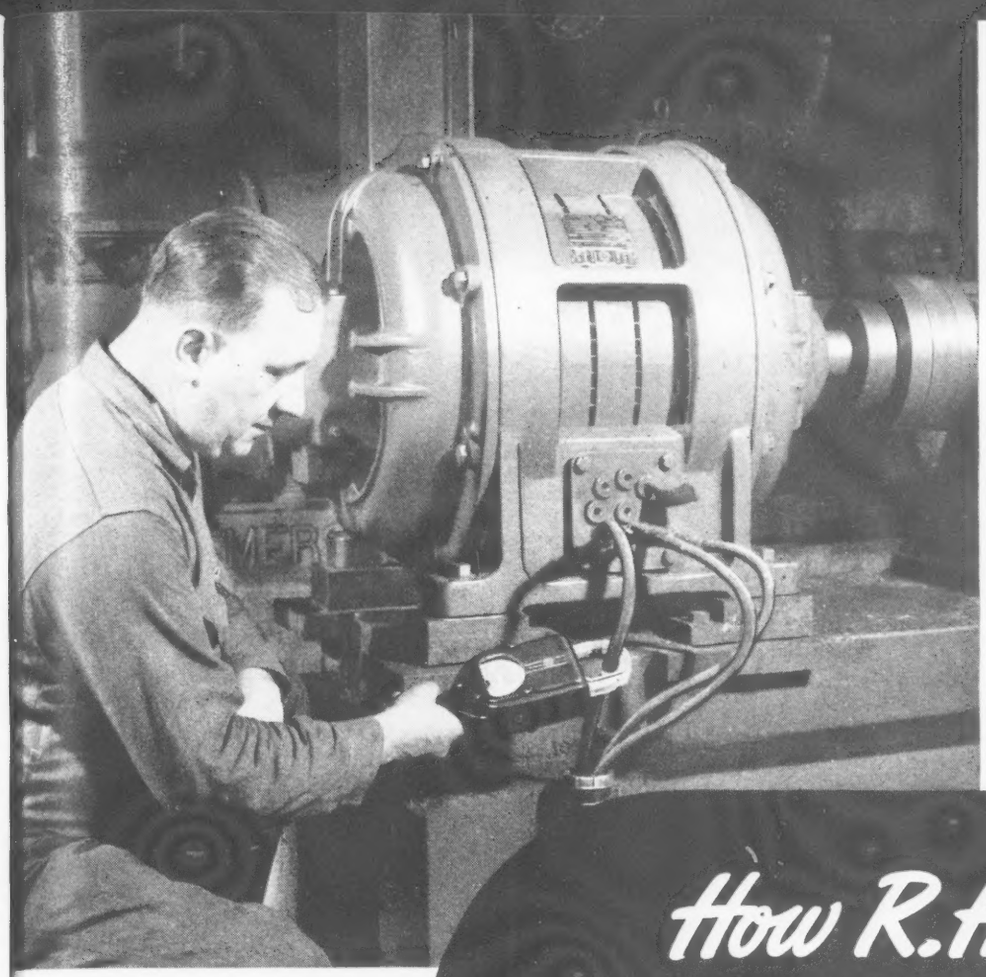
INCO ALLOY	*CONDITION*	*Tensile Strength 1000 psi.*	*Yield Strength 0.2% Offset 1000 psi.*	*Elongation in 2 in. per cent*	*Hardness Brinell 3000 kg.*	*Toughness Standard Izod-ft.-lbs.*
MONEL.....	Cold-drawn, as drawn.....	85-125	60-120	35-15	160-250	115-75
"K" MONEL....	Cold-drawn, heat-treated....	140-170	100-130	30-15	260-320	26*
INCONEL.....	Cold-drawn, as drawn.....	95-150	70-125	30-15	180-290	100-70
"KR" MONEL..	Cold-drawn, heat-treated....	140-170	100-130	30-15	260-320	..
"Z" NICKEL....	Cold-drawn, heat-treated....	160-190	120-150	20-7	300-380	25
"R" MONEL.....	Cold-drawn, as drawn.....	80-115	50-100	35-15	150-230	99
"S" MONEL.....	Castings as cast.....	110-145	80-115	4-1	275-350	9-3
NICKEL.....	Cold-drawn, as drawn.....	65-115	40-90	35-15	125-230	120

**Specimen completely fractured.*

INCO NICKEL ALLOYS *ARE YOUR ALLIES*

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings



How R. H. Forbes gets load and voltage facts IN A HURRY!

"WITH our plant operating three shifts a day, seven days a week, we must watch our electric equipment closely to keep it operating at peak efficiency and to prevent breakdowns. That means constant testing.

"The G-E hook-on volt-ammeter is the handiest instrument we have for this work, because it measures volts as well as amps, and enables us to make our tests quickly."

These are the words of R. H. Forbes, chief electrician, United Paperboard Company, Thomson, N. Y.

A 6-in-1 Instrument

The reason why the AK-1 hook-on volt-ammeter is so handy is that it's really six instruments in one. It has six ranges—0–15/60/150/600 amperes and 0–150/600 volts (for a-c circuits only).

To measure amperes, all you do is hook it around a conductor, flick the selector switch to **AMPERES**, and there's your measurement—no cutting of conductors, no interruption of service.

To measure volts, all you do is connect the voltage leads, snap the switch to VOLTS, and take the reading. You don't need any extra equipment.

Extension poles, in four- and six-foot lengths, are available for using the AK-1 on high-voltage circuits, and for reaching into inaccessible places. Also, a cowhide leather carrying case can be obtained for protecting the instrument when it is not in use.

For complete details, ask your G-E office for a copy of Bulletin GEA-2950. Or write to General Electric Company, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

WAR AGAINST WASTE CAN BE

by Stopping Valve Leaks

WITH

Dexter

VALVE RESEATING EQUIPMENT

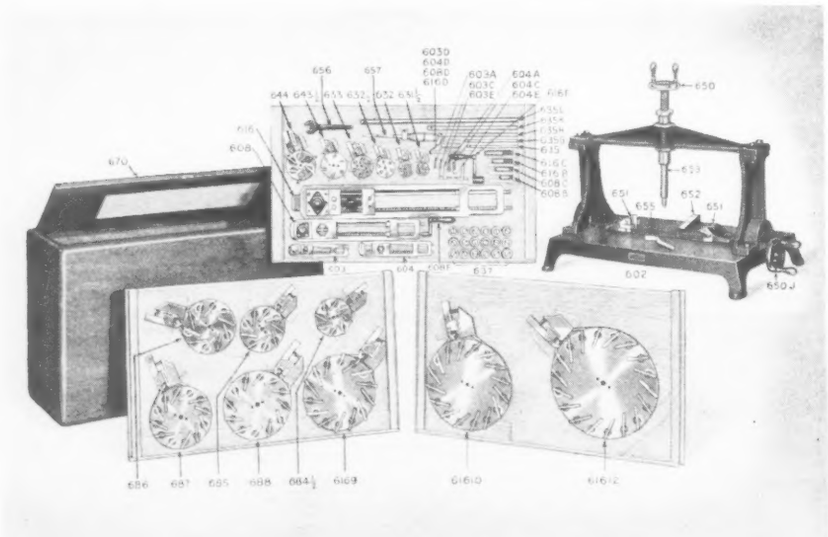
. . available for All Types of Valves

You have a definite need today for DEXTER VALVE RESEATING EQUIPMENT for GATE, GLOBE and PUMP VALVES, because it fits right into your maintenance requirements. This equipment will enable you to eliminate waste of steam, water and air caused by leakage losses through leaky valves. Furthermore it will insure you against costly and unnecessary shut downs.

You have a vital interest in equipping your plant to wage a successful war against waste NOW, because now is to the time to conserve materials, effort and labor and keep your plant in constant, economical operation and condition.

Look to the valves in your plant as a means of stopping leakage losses. Look to Dexter Equipment for proper valve maintenance and a means to avoid valve replacements and the delays incident to getting new valves or new valve parts (even if they are available). You can avoid time losses, too, incident to installing new valves by quickly, easily and economically reseating your present valves with Dexter Equipment. In many cases, the investment cost is being written off in less than six months through actual savings in time and material.

Every valve in your plant can be properly reseated with Dexter Equipment. Valves from the junk heap can be reconditioned the Dexter way.



TYPES AND CAPACITIES AVAILABLE

For Gate Valves—from 1½" to 48"
For Globe Valves—from 1¼" to 14"
For Pump Valves—from 2" to 15"

• • • •

DEXTER GATE VALVE RESEATING OUTFIT (No. 2-12-C) for refacing gate valves and discs 1½" to 12".

THE LEAVITT

WON IN YOUR PLANT
and Making Valves Last Longer

HOW GATE VALVES ARE EASILY RESEATED WITH DEXTER EQUIPMENT

1. Remove Gate Valve Bonnet and Disc.

2. Insert Cutter Support (A) and lock firmly in valve seat ring by Jaws (B) and (E).

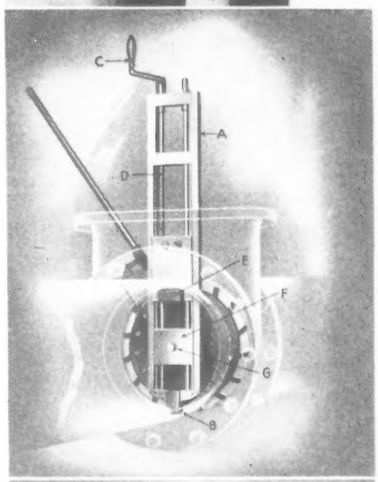
3. Insert Gate Valve Cutter (H) which is held in place by Feed Pin (G). Cutter and Feed Pin form a ball and socket joint which enables the Cutter to find and maintain the angle of the valve seat ring.

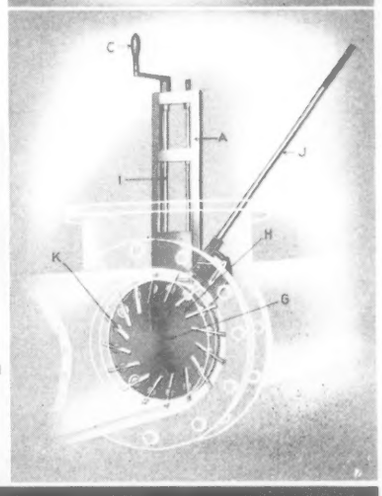
4. REFACE GATE VALVE SEAT. Rotate Cutter (H) by moving Handle (J) back and forth in slow even strokes, at the same time keeping a *very light pressure* on the Cutter by turning Crank (C) slightly. Blades (K) on all Dexter Cutters are staggered on the plate—no two blades are anchored at the same angle. This absolutely prevents any chatter and guarantees a smooth, true surface. After imperfections have been cut from valve seat surface, hold Crank (C) in position, without turning, and continue to rotate Cutter until it has cleaned up and put a polished finish on the valve seat. Reverse Cutter Support (A) and Cutter (H) and reface opposite valve seat in the same manner.

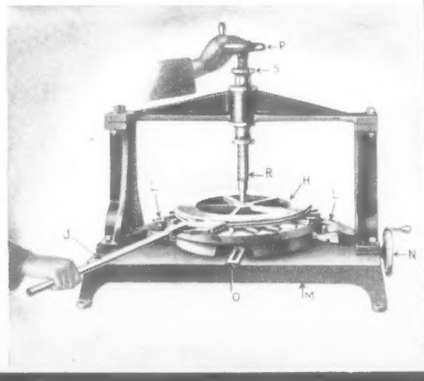
5. PLACE GATE VALVE DISC between Jaws (L) on Gate Valve Disc Cutting Machine (M)—Center automatically and lock in position by turning Hand Wheel (N). Level up the disc by moving Wedge (O) at the back of Machine (M).

6. Insert Cutter (H) and Feed with Hand Wheel (P). Feed Screw (R) and Cutter (H) form a ball and socket joint.

7. Reface Gate Valve Disc in same manner as for refacing valve seat. For finish tighten Lock Nut (S) and continue to rotate. Reface other disc surface in the same manner.







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WRITE AT ONCE FOR 32-PAGE CATALOG GIVING COMPLETE INFORMATION

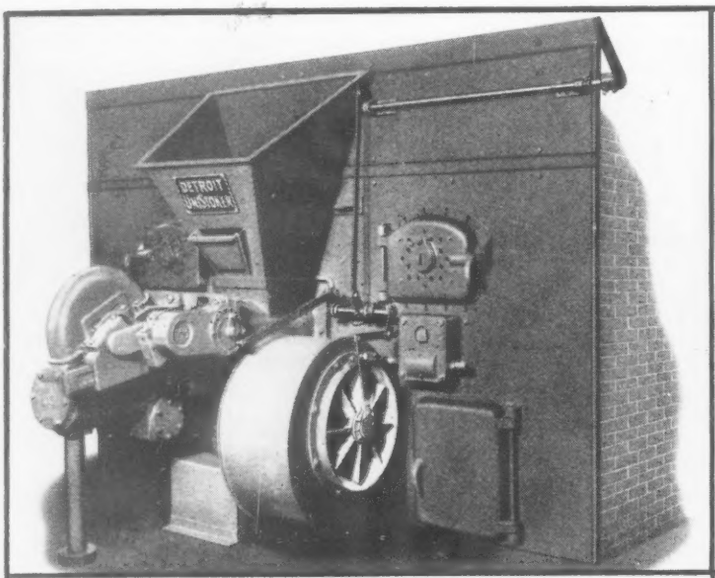
•

T MACHINE CO., ORANGE, MASS., U.S.A.

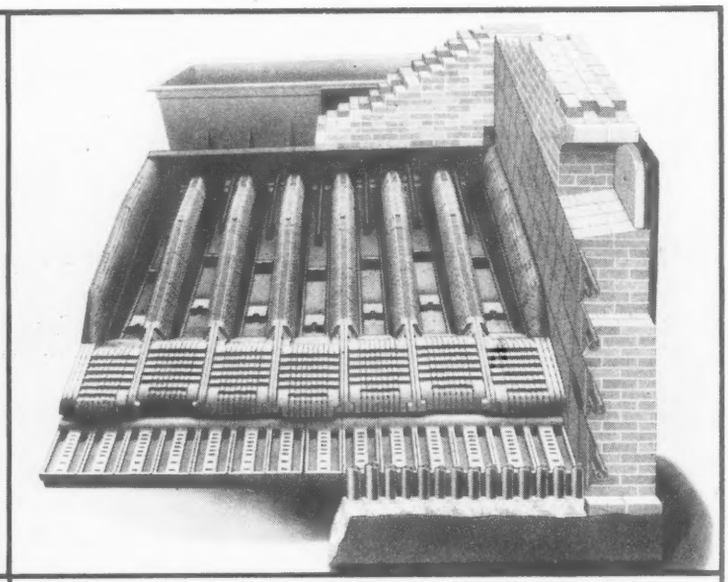
Approved BY

Before buying stokers, investigate Detroit Stokers, either Underfeed or Overfeed, in various types and sizes for all boilers and all grades of coal and plant requirements.

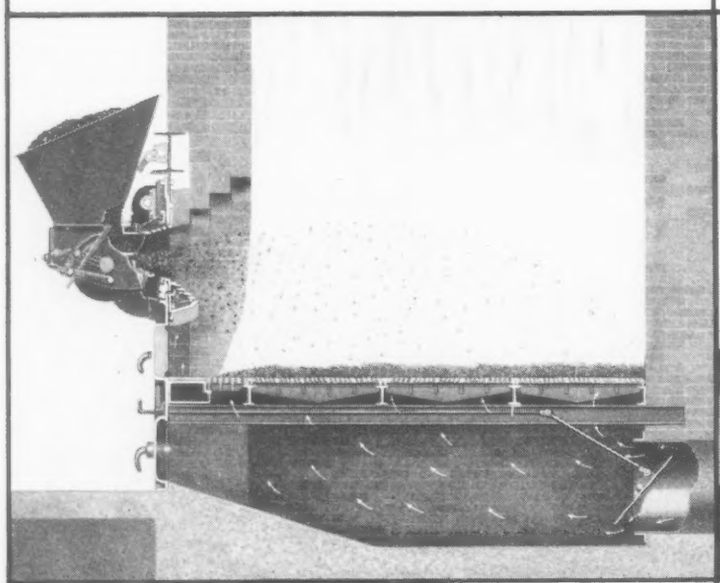
Detroit Stokers have been the choice of prominent Engineers and Architects for over forty years. We solicit your inquiry "on the platform" of maximum capacity and efficiency.



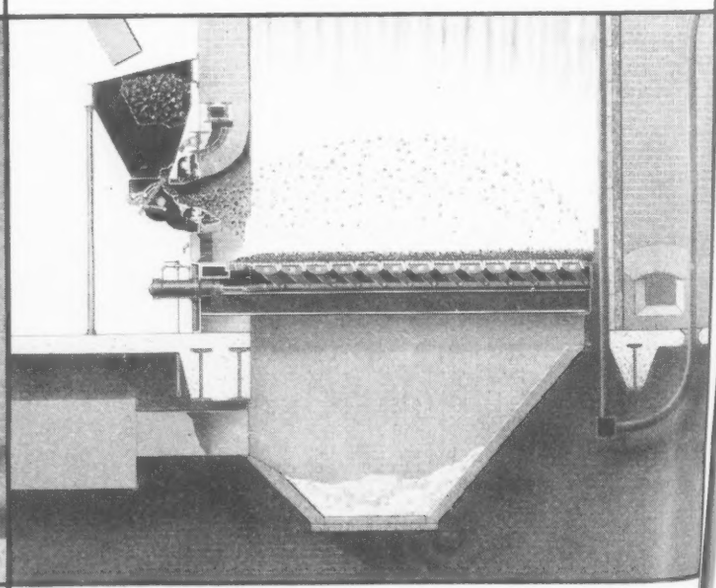
DETROIT UNISTOKER (With Detroit Adjustable Feed)
Unit Type—Underfeed Stoker, motor or steam turbine driven. Fuel and air, automatically controlled. Many sizes for 125 to 300 horsepower boilers.



DETROIT MULTIPLE RETORT (MC—Inclined)
Individual and *easy adjustments* of the stroke of rams and stroke of moving retort bottoms provide control of fuel feed and distribution *to each retort.*



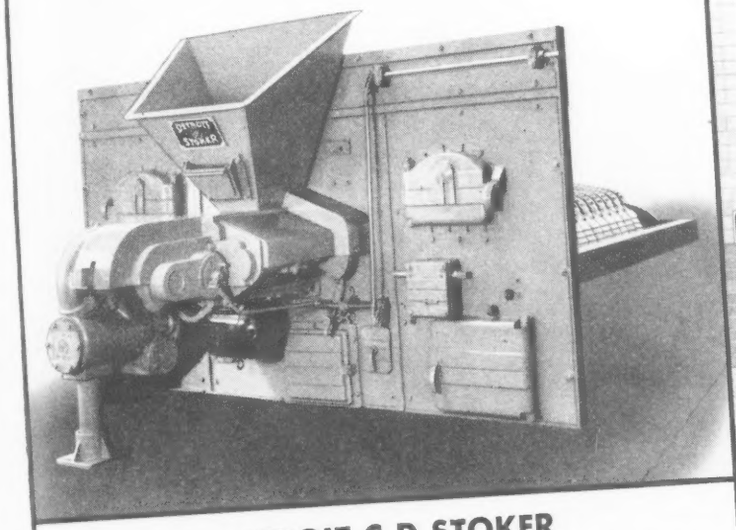
DETROIT ROTOSTOKER (Stationary Grate)
Overfeed Spreader Stoker with *Overthrow Rotor Action* gives uniform fuel distribution. Successfully burns an extremely wide range of fuels.



DETROIT ROTOSTOKER (Dumping Grate)
A solution for burning certain coals and especially in handling fluctuating loads. With coal, Roto-Stokers also used to burn wood and other refuse.

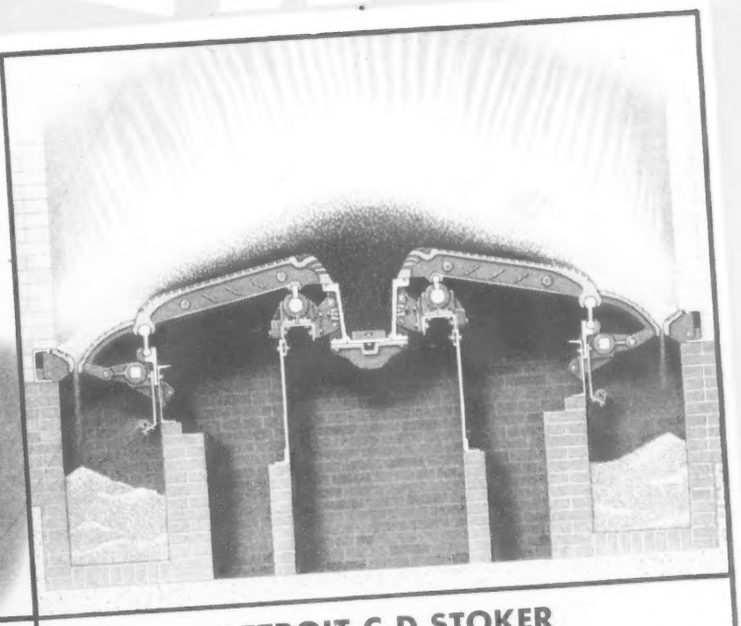
DETROI

POPULAR CHOICE



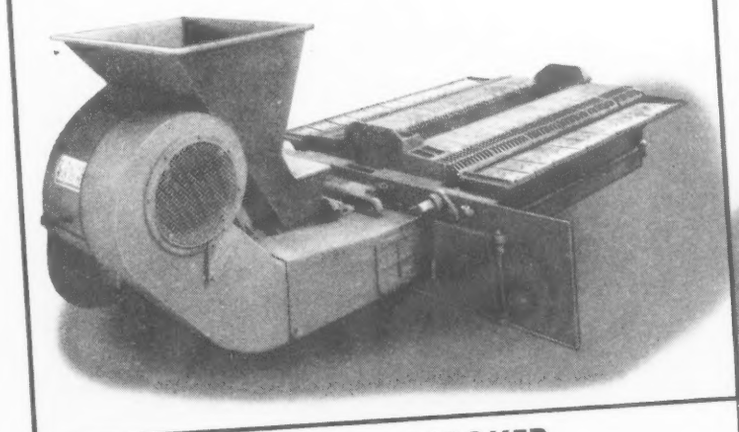
DETROIT C-D STOKER

Continuous discharge of ashes is a feature of this single retort stoker. Discharge sections have a rocking movement. Rate of discharge is controlled.



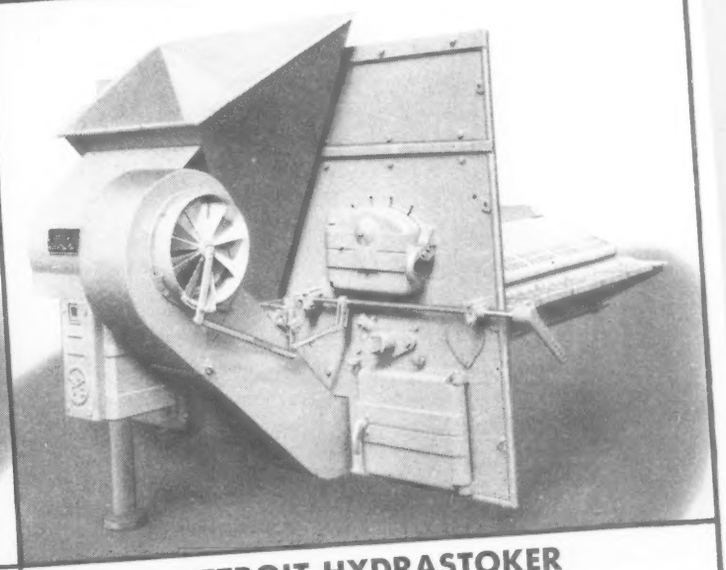
DETROIT C-D STOKER

Hollow air cooled grates preheat air for combustion—are alternately moving and stationary. Many sizes for all boilers from 300 to 500 horsepower.



DETROIT LOSTOKER

Plunger feed—side cleaning underfeed stoker for all makes of steel firebox, cast iron, or water tube boilers, 30 to 150 horsepower. A great coal saver.



DETROIT HYDRASTOKER

Hydraulically (oil driven), Single Retort—simple compact design. Provides wide range of fuel feed. Fuel and air controlled in proportion to the load.

STOKER COMPANY

Sales and Engineering Offices, General Motors Bldg., Detroit
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A TYPE FOR EVERY JOB

Send for Bulletin

Important Announcement—

Now you can get Electrifugal Pumps UP TO 25 HP!

Introducing the Big New 25 HP Member of the Famous Allis-Chalmers Electrifugal Pump Family . . . to Help You Cut Pumping Costs . . . Save You Space . . . Help You Pump More Gallons for Wartime Needs!

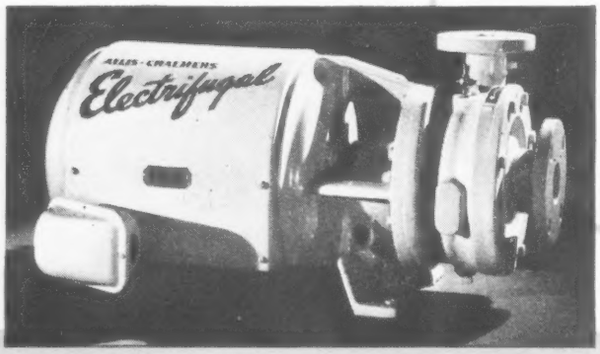
HERE IT IS — Allis-Chalmers' answer to industry's wartime demand for a complete line of the new streamlined Electrifugal Pump Units from ½ hp to 25 hp!

And what's important—this new size (25 hp) has all the same features that have made the recently introduced smaller sizes the *fastest selling pump line on the market.*

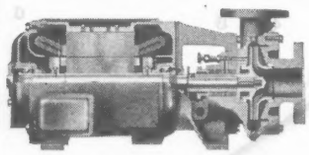
Unified "Tri-fit" construction for more perfect shaft alignment . . . less vibration and wear! Completely new splash-proof motor! One-piece frame that saves as much as 33% in space . . . cuts overhang as much as 40%! Indestructible rotor and distortionless stator, cast bronze protective sleeves! These and other features help you *cut costs up to 33% over conventional pump installations!*

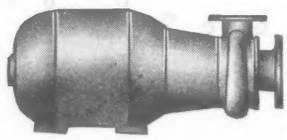
Don't delay! For early delivery date, call the engineer in the district office near you . . . Or write Allis-Chalmers, Milwaukee, Wisconsin.

A 1474



MAKE THIS 3 TO 5 TEST YOURSELF





The NEW Allis-Chalmers Electrifugal Pump has only three section-fits compared to five or more for old style pumps! That means more perfect alignment of the shaft . . . less vibration . . . less wear . . . less trouble Here's a pump that gives you more gallons . . . for less cost!

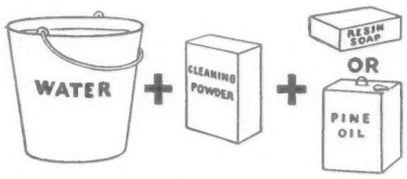
Allis-Chalmers Pumps Can Cut Your Pumping Costs

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

How to increase the Life of your Oxy-Acetylene Welding and Cutting Hose . . .

Uninterrupted use of the oxy-acetylene process is vital to industrial maintenance and production. It is therefore reasonable to expect the continued manufacture of adequate amounts of oxygen and acetylene hose for use in the many essential applications of this process. However — as with any product made of materials subject to strict rationing — certain limitations on manufacture of hose, and restrictions on sale, are inevitable. It is therefore to the advantage of everyone to increase the useful life of all oxygen and acetylene hose in service.

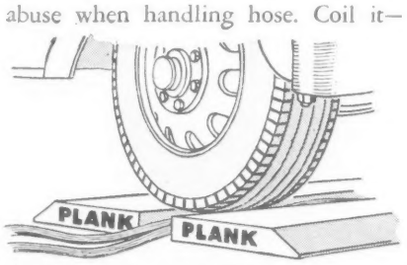
1. ***Protect hose from oil and grease,*** as these cause rapid deterioration of rubber. If oil or grease do get on hose, remove with water and any commonly used cleaning agent supplied in powder form, such as "Oakite;" or with con-



crete floor cleaning powder. Addition of about 5 per cent pine oil or resin soap will facilitate cleaning. Do not use gasoline, kerosene, or any cleaner containing caustic soda or potash.

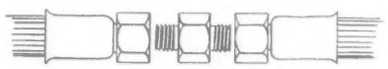
2. ***Avoid burning of hose*** due to careless use of blowpipes, or from permitting hose to contact hot objects.

3. ***Avoid kinks*** and undue abrasion or abuse when handling hose. Coil it—



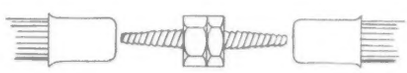
don't drag it—when moving to new locations. If hose crosses the path of vehicles, protect it by planks.

4. ***Use short lengths of hose.*** Short lengths not only are more readily available, but are more easily protected from



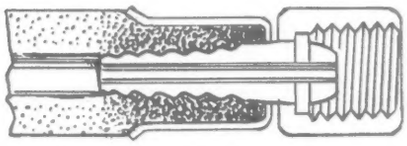
damage. By inserting couplings in the ends of hose as illustrated, several short lengths can quickly be joined when required.

5. ***Test hose regularly over its full length*** by immersing it in water while



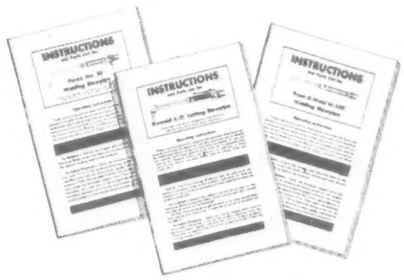
under operating pressure. Cut out leaky sections at once and rejoin the hose ends by using hose splices as shown above.

6. ***Test all hose connections for leaks*** by brushing on soapy water while the hose is under operating pressure. If leaks are found—or if hose ends are worn—cut the ends off back to sound



rubber and reassemble ferrules and nipples, as diagrammed above.

7. ***Operate blowpipes only at pressures recommended*** in the apparatus instruction book. Keep blowpipes in



good condition to avoid damaging flashbacks. Use oxygen and acetylene hose only for the purpose for which each is intended.

8. ***Purchase hose only when actually needed.*** Rubber deteriorates while on the shelf, with resultant shortening of useful life.

* * *

Send for Helpful Literature

The steps described here not only will conserve hose, but will conserve gas and contribute to the safe use of the oxy-acetylene process. Duplicate copies of the instruction booklets furnished with apparatus supplied by Linde are available without cost upon request. Also available is the helpful booklet, "Precautions and Safe Practices", which gives full instructions for setting up apparatus correctly. Write for the copies you need—today.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street, New York UCC Offices in Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

You Can Obtain Copies of this Advertisement For Distribution in Your Shops . . . or to Post on Your Bulletin Boards . . . Upon Request.

THEY CALLED IT

"The Back Door of HADES!"

And you couldn't blame these poor fellows—for they had to swallow the smoke and fumes of their own two- and three-engine trains—as well as that of previous trains—on the tough upgrade haul through a famous tunnel in the Alleghenies.

This was the setting for a pioneering job. Sturtevant had successfully ventilated ships and buildings but could they do it here—in a 3000-foot tunnel filled with the heat, smoke and fumes of almost 100 trains a day? Railway officials thought so . . . Sturtevant Engineers went to work. Two Sturtevant Fans were installed at the west portal . . . big enough to blast out the smoke and fumes as soon as they left the engines.

For the first test run on April 19, 1901, spectators gathered at the east portal—literally cheered when the smoke came out 2 minutes ahead of the train. The engineer on the rear engine rode with his window open for the first time—saw the smoke from his own stack seven cars ahead, a clear tunnel behind.

Soon Sturtevant ventilated many other famous railway tunnels including Big Bend, Stampede—and the 4½ mile Connaught Tunnel in Canada, requiring fan wheels alone that are 13 feet in diameter.

Motor travel brought still another problem to tunnel ventilation—deadly fumes. Sturtevant was ready. For the New York-New Jersey Holland Tunnels a new system was developed —fresh air supplied at the roadway level, fumes exhausted at the ceiling, a *complete* change of air every 90 seconds.

Sturtevant
Puts Air to Work
for
Tunnel Ventilation

Handling 63,000 Cars a Day

—a peak load that the Holland Tunnel connecting New York and New Jersey takes in stride. First of the modern vehicular tunnels, this Sturtevant system pointed the way for other tunnels from coast to coast.

Clearing the International Air

—by exhausting foul air and motor fumes in the mile-long Detroit-to-Canada Vehicular Tunnel. 24 Sturtevant Fans flood the tubes with a *complete* change of air every 90 seconds.

Today, the comfort and safety of the air you breathe in vehicular tunnels from coast to coast is taken for granted—thanks to Sturtevant pioneering in ventilation.

B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal

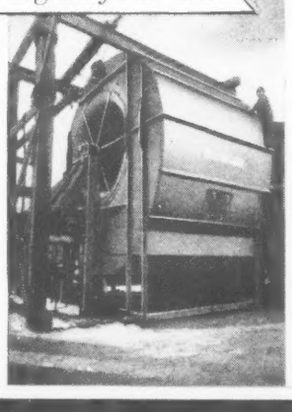
Sturtevant
REG. U.S. PAT. OFF.

Puts Air to Work

STURTEVANT — FOUNDER OF THE AIR HANDLING INDUSTRY

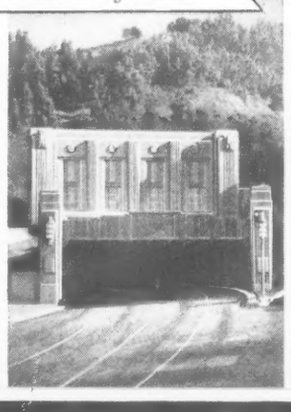
For 7 Miles of Super-Highway Tunnels

—on the new 160 mile Pennsylvania Turnpike, Sturtevant built 26 giant ventilating fans like the one shown here—on test before shipment from Sturtevant's Hyde Park plant.



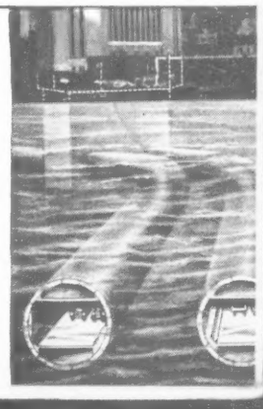
Piercing the Berkeley Hills

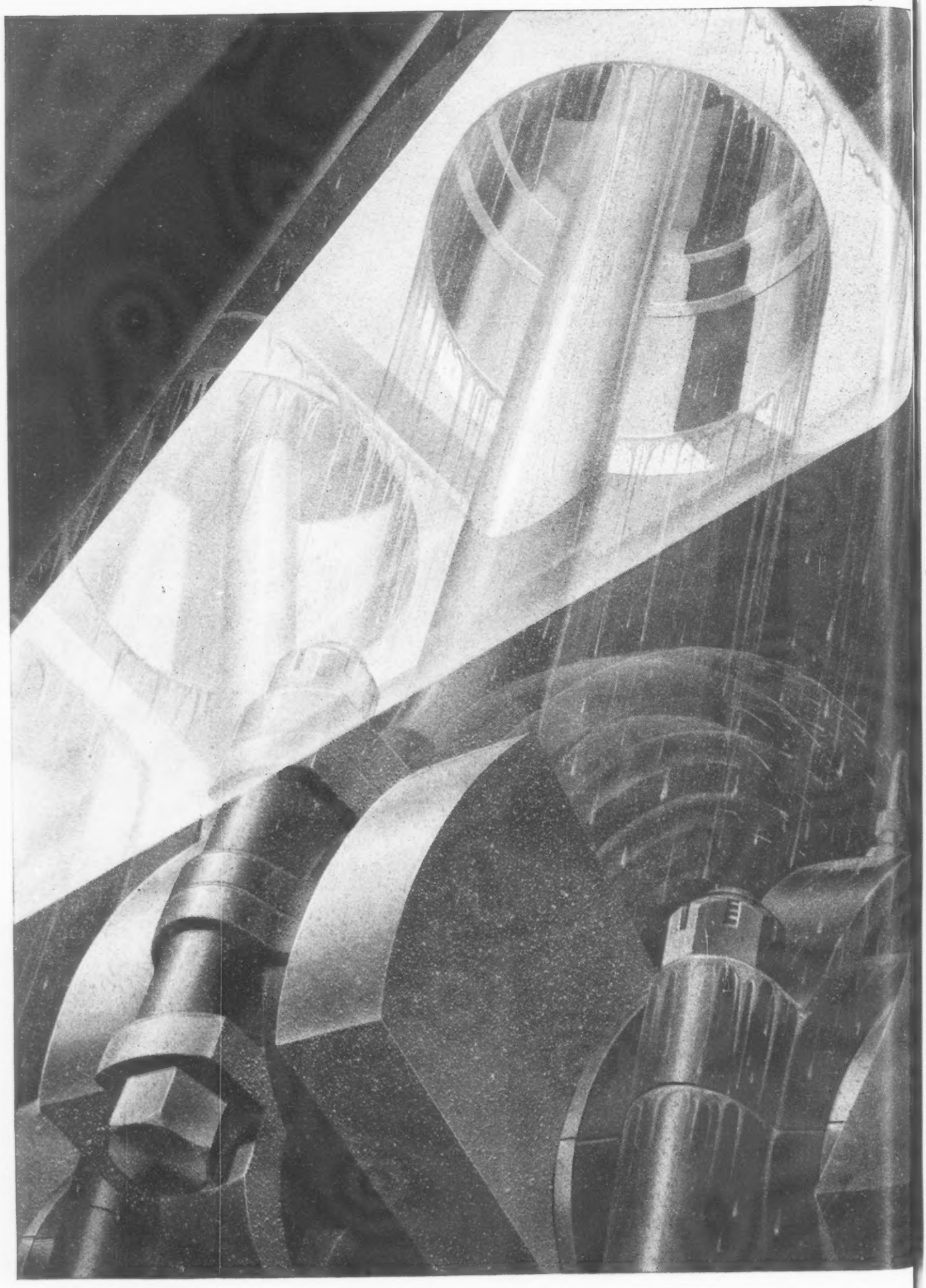
—between Alameda and Contra Costa Counties in California, the Broadway Low Level Tunnel requires 16 Sturtevant Fans to flood the tunnel with fresh air—keep carbon monoxide content less than 2 parts to 10,000—at all times.



95 Feet Under the East River

—ventilation is completely adequate and unfailing in New York's new Queens-Midtown Vehicular Tunnels—thanks to the 46 Sturtevant Fans that handle a total of *21,000 tons of air per hour.*





"Air Raid" Protection Inside a Diesel Engine

A "CORRECT" ANSWER TO THE PROBLEM OF OXIDATION IN DIESEL CRANKCASES:

Problem: The crankcase of a modern Diesel engine is a "torture chamber" for lubricating oil. As the oil escapes from the ends of the bearings, it is whipped into a fine mist by the racing crankshaft and rods. In this finely divided form, the oil is attacked from all sides by *hot air*. The constant churning and presence of impurities accelerate the tendency for oil to oxidize and form deposits.

Answer: To resist this terrific punishment, oil must have the greatest possible stability. It must be made from carefully selected crudes; refined with greatest skill. Backed by 76 years' experience, Socony-Vacuum has created "correct" oils for *every* type and size of Diesel engine.

Gargoyle D.T.E. Oils 1-to-5 are designed for maximum protection and stability in large and intermediate Diesels. *Delvac "500 Series" Oils* are specially made for small, high-speed engines.

TO HELP MAINTAIN CAPACITY PRODUCTION, CALL IN

SOCONY-VACUUM for "Correct Lubrication"

SOCONY-VACUUM OIL CO., INC. — Standard Oil of N. Y. Div. — White Star Div. Lubrite Div. — Chicago Div. — White Eagle Div. — Wadhams Div. — Southeastern Div. (Baltimore) — Magnolia Petroleum Company — General Petroleum Corporation of Calif.

GARGOYLE

Lubricants

CONTROL OF THE AIR
MORE POWER
FOR THE U. S. ARMED FORCES
8 U. S. Army Air Stations
2 U. S. Navy Air Stations
11 U. S. Ordnance Plants
5 U. S. Navy Yards
3 U. S. Naval Training Stations
5 U. S Army Camps
Have Installed
REPUBLIC COMBUSTION CONTROLS
AND INSTRUMENTS

Requires Control on the Ground

To Keep 'em Flying, extensive air base facilities must be provided and maintained. These facilities, in order to function, must be supplied with vast quantities of steam, electricity and other power services . . . and they must be supplied without interruption. The vital factor in maintaining these services is the steam generating plant . . . here all of the power services originate.

To guard against possible power failures, it is, therefore, of utmost importance that the steam generating units be equipped with the necessary instruments and controls to assure their efficient, uninterrupted operation even during a blackout.

Republic instruments and automatic combustion control systems, because of their excellent performance record throughout industry, are being specified for many of the new U. S. Army and Navy defense establishments.

If you have a steam generating problem, our engineers will be glad to discuss it with you without obligation. If you would like to have complete data on Republic automatic combustion control systems, just write for Data Book No. S-21 . . . we will be glad to mail it to you.

REPUBLIC FLOW METERS CO.

2222 Diversey Parkway, Chicago, Ill.

12 Actual Experiences

A FAILURE made this.
Steam plant A SUCCESS!
TO HALVE THE STEAM COSTS!
BECAUSE WE WERE CONTRARY... THE CUSTOMER NOW SAVES...
$10,000.00 Every year!
SOLD THIS JOB...
FIGHTING THE FIRE...
they called us in again!
BOILER PLANT THAT COST $25,000.00 LESS
Reduces Operating Expense Three Ways!
We Didn't
...But Never Using...
100 hp of Extra Steam Capacity
Paid off.....in 3 years
LESS EXPENSIVE STOKERS
...for the right STEAM GENERATING EQUIPMENT
COMBUSTION ENGINEERING

Reproductions of the twelve case histories as they previously appeared among these pages.

Reprints of the original advertisements are available. Use the numbers on the right hand page to request copies of any or all of them.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

COMBUSTION

PROVE 1 VITAL POINT

for users of

STEAM GENERATING EQUIPMENT

The Twelve Experiences

These twelve case histories prove how C-E does much more for its customers than merely build steam generating equipment. In each example cited, C-E engineers perceived a better way to do the job . . . *they suggested a more expensive installation when it meant greater long-term economy . . . they recommended the less expensive solution when study revealed its adequacy . . . they urged alternative equipment when it pointed to the better installation* . . . and in several cases these recommendations placed a valued contract in jeopardy in order to maintain a principle of service that's dedicated primarily to the best solution of the customer's needs.

1. ***Chemical*** company accepts C-E's counter recommendation on equipment. Result—lower initial cost, higher efficiency and reduced ash-handling expense.

2. ***Mining*** company agrees to change of stoker specification after examining results of fuel tests. Result—7 years of high availability, low maintenance.

3. ***Paper*** mill induced to adopt a different type of installation that utilizes cheapest available coal. Result—operating costs 50% less.

4. ***Transportation*** system shown how to avoid the contemplated scrapping of two old boilers. Result—total cost of installation is cut in half.

5. ***Brewery*** influenced by insistent recommendation to change type of stoker. Result—an annual saving of $10,000 in fuel and maintenance.

6. ***Flour*** mill returns to C-E equipment recommendation after trying alternate method. Result—increased steam needs are satisfied; rising maintenance halted.

7. ***Coal*** company converted by fuel tests to a different method of firing. Result—more economical operation through use of lowest grade fuels.

8. ***Hospital*** learns how to save its existing boilers. Result—$25,000 lower cost plus savings of fuel, maintenance and operating expense.

9. ***Textile*** mill follows recommended purchase of steam capacity in excess of need. Result—material fuel saving and lower maintenance.

10. ***Public*** works shown how additional steam can be obtained despite limitations of existing space. Result—25% greater steam capacity.

11. ***Plastics*** plant is persuaded that objectives can be accomplished with less expensive stoker. Result—installation paid off in 3 years.

12. ***Oil*** equipment manufacturer agrees to scrap existing stokers in "working order" and spends $13,000 more. Result—saves $9,000 a year in fuel.

The One Point

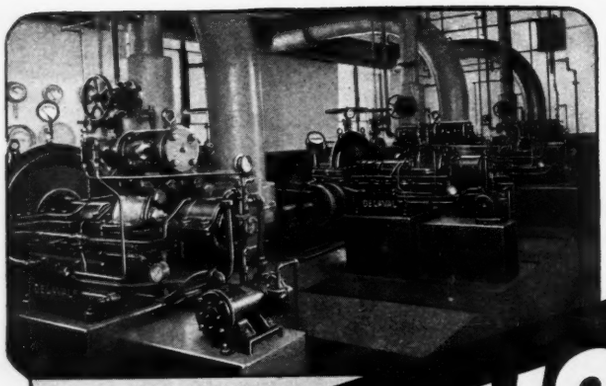
C-E has the experience and engineering competence to arrive at the one optimum solution to meet the particular combination of steam demand, fuel supply and other conditions existing for any job. Then, because C-E offers a complete line of steam generating equipment, it has the unprejudiced point of view toward alternative practices that eliminates the source of bias. Moreover, C-E has a reputation for long-run service satisfaction which must be protected, and every C-E proposal for steam generating equipment, whether it be large or small, simple or complex, must meet this standard.

(See note on left page regarding reprints of these case histories)

A-845

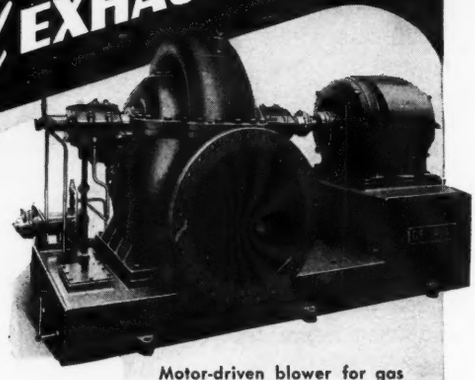
COMBUSTION ENGINEERING COMPANY, INC., 200 MADISON AVENUE, NEW YORK, N.Y. • CANADA: COMBUSTION ENGINEERING CORPORATION, LTD., MONTREAL

ENGINEERING



Three turbine-driven exhausters drawing gas from holders and forcing it through condensers, scrubbers and purifiers, light oil scrubbers and meters to storage holders; 2280 to 5700 cfm. each against a maximum of 60 in. water column. Hydraulic governors provide for quick adjustment of delivery and pressure.

DE LAVAL BLOWERS, COMPRESSORS and EXHAUSTERS

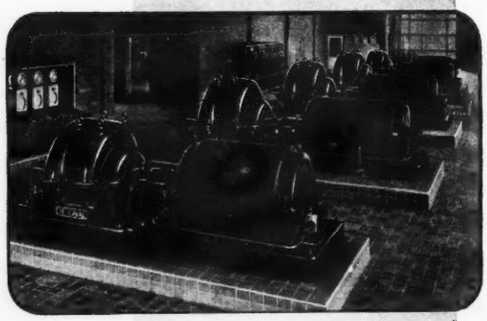


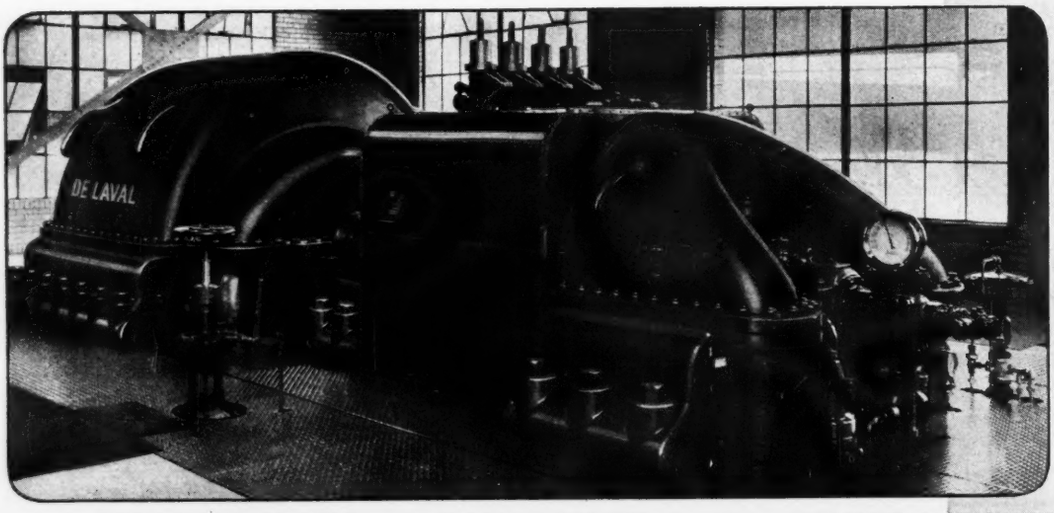
Motor-driven blower for gas plant; 26,200 cfm. against 54 in. water column.

are built for all volumes and for pressures up to 100 psi. They embody scientific and sturdy design, which contribute to continuous service and long life. Modern De Laval steam turbines driving these compressors are adapted for high pressure, high temperature steam, with segregation of moisture in low pressure stages to increase efficiency and reduce erosion, and with perfected governing systems to hold constant pressure, constant volume or constant mass flow.

By using De Laval double helical speed-increasing gears, standard speed motors are combined with high speed blowers or compressors, thereby avoiding the complication and expense of a greater number of stages.

State requirements and ask for Catalog F-3821.





Compressors in activated sludge plant; 3 rated at 47,000 cfm. each, and 2 at 25,000 cfm. each; all against 7.4 psi.

Turbine-driven blast furnace blower; 85,000 cfm. against 30 psi.

DE LAVAL Steam Turbine Co.

TRENTON, N. J.

MANUFACTURERS OF TURBINES STEAM, HYDRAULIC PUMPS CENTRIFUGAL PROPELLER ROTARY DISPLACEMENT MOTOR-MOUNTED, MIXED-FLOW CLOGLESS SELF-PRIMING CENTRIFUGAL BLOWERS and COMPRESSORS GEARS WORM, HELICAL and FLEXIBLE COUPLINGS

VOLUME 86, No. 3

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MARCH, 1942

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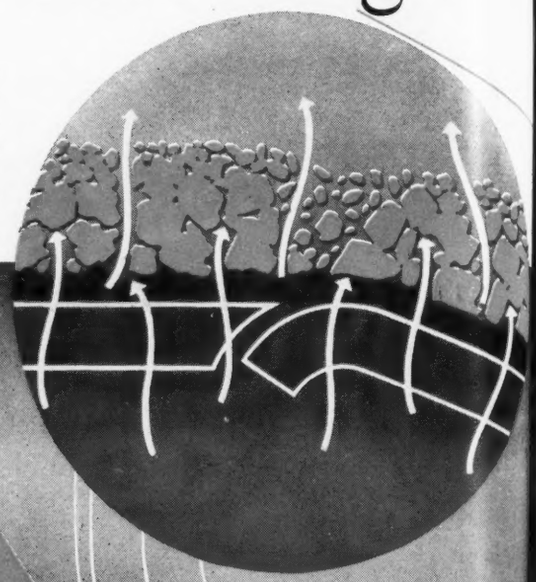
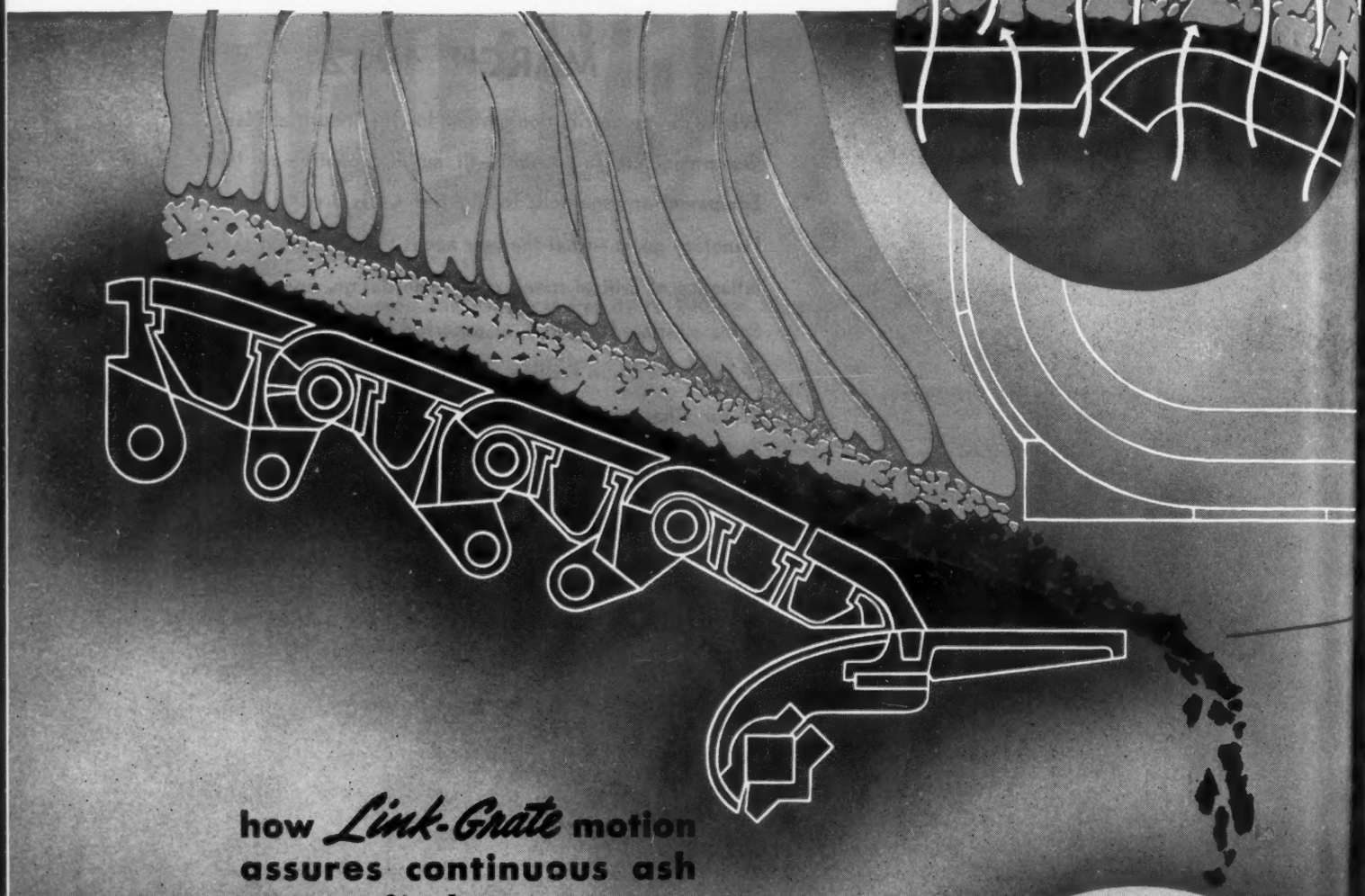
continuous ash discharge

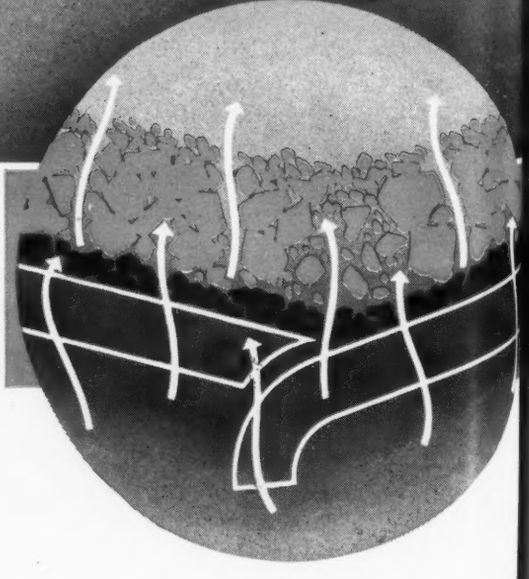
grates up—First movement of the Link-Grate breaks open the fuel bed. It is thoroughly permeated with low-pressure air flowing up through the grates. Fused ash is oxidized, clinkers broken into small, friable pieces. Fuel bed is kept porous without barring or hooking.





how *Link-Grate* motion assures continuous ash discharge

grates down—With this second basic movement, the fuel bed is cracked, crumbled and kept porous for uniform flow of gases throughout the entire combustion zone. Complete cycle produces an undulating motion which positively conveys fuel bed rearward, and feeds ash off the ash discharge plate. This eliminates the need for periodic dumping.



"...and we do mean continuous"

no periodic dumping, hooking and barring

...with the *Link-Grate* STOKER

Truly continuous ash discharge means just this: that the stoker conveys refuse to the ashpit automatically—that the ash is maintained in friable, readily disposable form without periodic hooking, barring, or dumping. Because of Link-Grate motion you can get *truly continuous* ash discharge with Westinghouse Type SDL Stokers.

This continuous, controlled motion of the grates promotes unrestricted flow of the entire fuel bed. It prevents damming of the fuel bed with resultant matted fires and clinker formation. At every cycle of the Link-Grate operation there is a positive movement of the fuel bed toward the ashpit, a continuous process that eliminates the need for periodic dumping.

In terms of operating economy and high availability—continuous ash discharge saves money by reducing outages, by minimizing grate replacements and by completely eliminating irregularity in heat output caused by periodic dumping. The efficiency curve stays high and steady with any grade of bituminous coal you can get.

J-50403

More facts for stoker buyers

Send for these Link-Grate fact books. Find out why Link-Grate stoker users in more than 40 classifications get *more steam per pound of coal.* Bulletin 3039 (multiple retort) Booklet 2196-A (single retort). Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. Ask your Westinghouse representative to show you a Link-Grate stoker in service.

Westinghouse

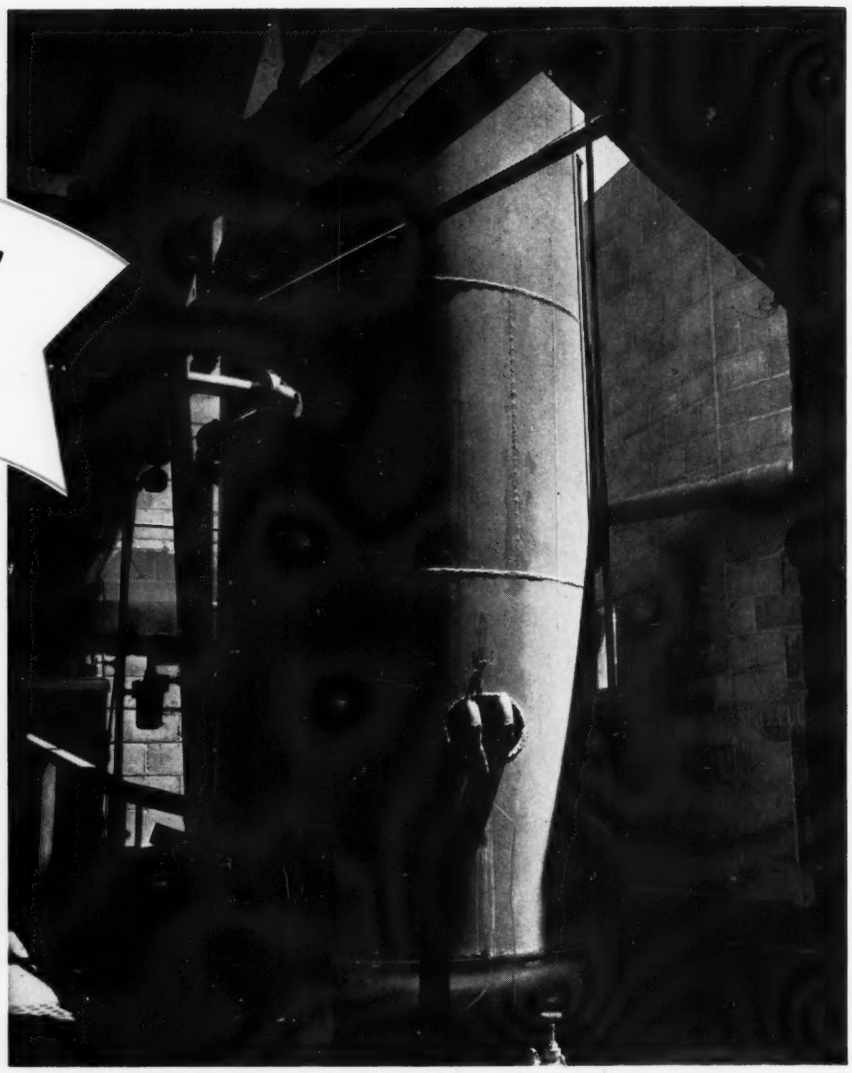
FOR PLANTS THAT CAN'T AFFORD EMERGENCIES

BYERS WROUGHT IRON

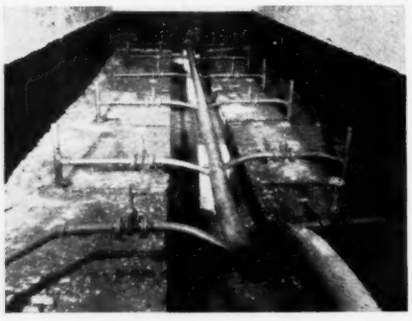
With more plants working on war production today, the question is not "How much will repairs cost us in money?" but "How much will they cost us in time?" In either case, the only economical material is the one that lasts longest.

If you have any services where corrosion or fatigue is creating repair problems, it will be worth your while to find out—on the basis of past performance in similar applications—what wrought iron can do. Our Engineering Service Department will be glad to give you full information. Ask, also, for our new General Catalog.

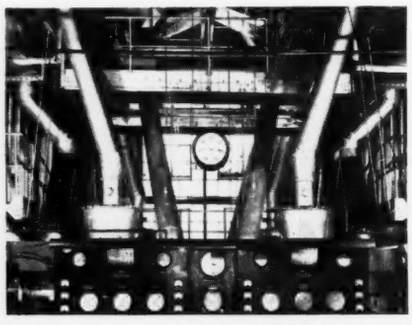
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.



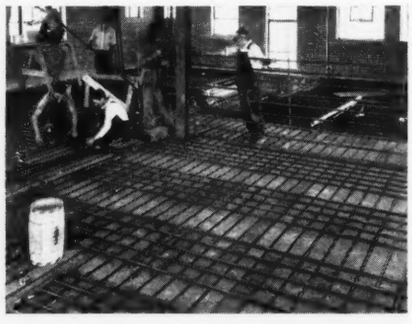
This 5000 gallon wrought iron tank at the Van Raalte Silk Company, Tonawanda, N.Y., replaces one made of ordinary materials that failed in only 5 years. A 3000 gallon wrought iron tank was ordered at the same time. Wrought iron's unusual life in such applications is indicated by the many tanks and standpipes built of wrought iron in the last century, and still on the job. Byers Wrought Iron tanks are also handling a variety of process liquids. Ask for tank bulletin.



These branches and header from some of the 22 artesian wells used by a large manufacturer are wrought iron. Selection was based on the many years of service already given by the wrought iron drop pipes. Ask for piping bulletin.



Many railroads and industrial plants use wrought iron for coal handling equipment because of its demonstrated longer life. The illustration shows 7 chutes in the boiler room of a large concern. Ask for coal handling bulletin.



The ease and speed of installation of Radiant Heating recommend it for many plant heating jobs. Byers Wrought Iron provides the necessary corrosion-resistance to assure long, trouble-free service. Ask for radiant heating bulletin.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

"Ten Silver Months . . ."

"EVERY WEAPON *we make today is worth ten that we might produce next year; for this year – 1942 – is the critical year in the existence of the United States.*"

This grim challenge was thrown at American industry by Donald Nelson in his first speech as chief of the War Production Board. He was speaking to a group of business paper editors, called together to receive at first hand Mr. Nelson's urgent message to the industries they serve.

"We've wasted the golden months", he declared, "the months in which we could have expanded our steel industry, our chemical industry, our copper industry, and all the others, so that we would have plenty of everything. But we still have ten silver months – the months that remain in 1942–and in them we can do things that we never thought possible."

To that objective Mr. Nelson has dedicated his high talents and boundless energy. And to that task he asks American industry to apply the full measure of its resources and skill.

That challenge should be all that it takes to exact from industry the last ounce of its energies. For by now we all can see that in this war the American way of life is at stake. American industry is the essence of the American way of life. Neither can survive without the other. So, even if it had no better reason, industry must go all out to win this war as a measure of self-preservation. Here self-interest and patriotic duty are synonymous. American industry cannot afford to let America lose this war.

The 1942 job is crucial. If it is well done we have a chance to win. If it is badly done we cannot possibly win. There is the measure of the responsibility that now rests upon the shoulders of industrial management.

It is not just Donald Nelson who asks this of industry. He speaks for the millions of fighting men – on land, at sea, in the air – the world over, whose eyes turn so desperately to the workshops of America. There and there alone can they see the hope of victory.

The people of America are not going to let those men down. They demand of industry every effort and every sacrifice that may be necessary to back them up. On that score, American industry stands, of necessity, on trial before our people. It must come through – or else!

* * *

As industry goes all out to meet this demand, its management asks of those who set its tasks and supervise its performance the utmost possible cooperation. It asks of them specifically an understanding of its problems and a chance to work them out without unnecessary interference. It asks for protection against attack from the rear while it concentrates its energies against the common foe. It asks a truce on economic reforms and social experiments that have nothing to do with winning the war and that are bound to arouse misgiving and mistrust amongst the proprietors of industry. Above all, it asks that it be not made a political scapegoat for every deficiency that is sure to develop in the confusion of a war effort.

This does not mean that industry resents honest criticism or constructive direction. Neither does it mean that it is unwilling to do its best unless it can have its own way in all things. The managers of industry are practical men. They know better than anyone else that unprecedented conditions call for new methods, that they must be open-minded to every criticism sincerely directed toward winning the victory. They know that no one can afford to be smug in the face of a national crisis.

There would be no point to my rehearsing here the pros and cons of such criticisms. Time is too short for that. Only in its performance can industry write a convincing answer to its critics. But as a help toward the achievement of that performance, I should like to clear up, if I can, one prolific source of misunderstanding and mistrust.

I refer to the solicitude of industrial managers as to where their companies may find themselves after the war. *This concern for the future sometimes is misinterpreted to mean that management is blind to the urgency of the present. But it does not mean that. It is a perfectly natural anxiety that must be felt by any responsible management operating under the American enterprise system – which is one of the things we are fighting to preserve.*

Under our system, the managers of industry cannot but feel a sense of responsibility to its owners, not merely for current dividends on their investments but also for the conservation of their properties. That means they must feel some concern for what may happen after the war to a business that now must go all out for the war. That, indeed, is but part of a general concern over what may happen to the whole American way of life after the war that we are fighting for its preservation.

To give practical effect to that concern under present conditions is one of the problems of management. It is not an insuperable problem. Competent management will be able to surmount it, I am sure. But the right kind of help from those in authority can make the job a lot easier. And let us note in passing that the problem cannot be written off, as some critics of business seem to think, merely by setting off against it the profits that business can make on war contracts. That misses the whole point.

For a business enterprise is not, as many seem to think, just a "profit-machine." It is not set up and operated by its owners and managers for the sake of this month's or this year's profits, without regard to any other consideration.

The fact is that any worth-while business must operate as a going concern. It consists not only of stockholders and managers, but also of employees, markets, distributors, and dealers. Mostly, I might say, of markets, distributors, and dealers. They are the "reason for being" of any business, the source of its payrolls and its profits.

No competent management wants to scrap such essential elements of its business just for the sake of war-bred profits, however large they might look . . . at the moment. Most of the original reluctance to get into arms production, for which industry has been criticized, was not due to a "greed for profits", as has been charged. Rather did it arise from management's mistrust of "war profits" that can be made only by sacrificing the essential elements of a healthy business.

* * *

But now industry faces a dire national emergency. The survival of our country and all its institutions – including American business–is at stake. So management must shape its course to meet without stint every need of the war

effort. That means it must subordinate to that effort every other concern. To lose the war is to lose all. We must first win the war if we would save anything.

To the men of management that presents a grave responsibility. It is fair to ask whether government can do anything to help them meet it. One simple thing I think government can and should do. It cannot dissolve all the concerns of management, but it can help substantially.

Government should do all it can to help management conserve those assets of business that will contribute to post-war reconstruction, when that can be done without prejudice to getting on with the war.

Let me explain. Broadly speaking, every business comprises three elements. One is its tangible assets – its factories, machinery, equipment, and materials. Another is its productive capacity – its management, organization, trained working force. A third is its intangible assets – the goodwill, familiarity, acceptance, and recognition that it enjoys amongst its dealers, customers, and prospective customers.

When the nation goes to war government becomes the one dominant customer of a business. Of these three elements, the first two – plant facilities and organization – become of paramount importance to the job in hand. But so far as the government buyer is concerned, the third drops to minor importance.

But that third element cannot be ignored by the managers responsible for that business. For it will be their mainstay when they must rebuild that business after the war, when government has lost all interest in its existence, except as a source of tax revenue. That is why government can help greatly if now, during the war, it recognizes the legitimate concern of management to conserve those assets that will be essential to survival after the war.

Everyone recognizes the obligation of government to demand that the individual business go all out for war production, to forbid the production of goods not essential to wage war and to commandeer those that are, to require that a business sacrifice its markets and disrupt its distribution organization. No one questions the right of government to restrict arbitrarily the amount of earnings that a business may retain as profit from its war activities. In short, no one questions the right of government to become the dominant partner in any business that may be needed to win the war and, as dominant partner, to put the national need above any conflicting interest of the business.

But, as it does all this, government should remember that the survival of that business is staked on the public's knowledge and use of those discontinued or commandeered products, on the stability of that crippled dealer organization, on the ability of the business to maintain its standing in a market-place from which, temporarily, it may be barred.

And government can help management to deal with the exacting task it now faces, if it will do all it can to avert the needless sacrifice of business interests that do not conflict with war needs, if it will but remember that one of these days, that business again will be on its own, gathering up whatever resources it may have left, recreating its markets, rebuilding its distribution channels, reestablishing itself as a going concern . . . and doing all this in a competitive world without benefit of war orders.

The only foundation upon which any business can hope to rebuild when that day comes is its customers' memory of its name and their understanding of its products. Whatever credit may be coming to it for its war effort will not avail it very much if it permits itself to be forgotten. Its chief assets in that day will be the identity, recognition, and acceptance it still enjoys amongst those to whom it must look for business.

That is why so many business men, already going all out on their war jobs, become apprehensive whenever some word or act of a legislator or government official seems to question the validity of their sales, promotion, and advertising activities during the war. For they know that it is by such measures alone that any management can hope to conserve – while its business goes to war – the values it will need when it returns to civilian service.

That is why I ask government to do all it can to allay such uncertainties, to reassure business of its desire to help conserve those intangible assets that mean so much to business security. For that, I believe, will strengthen the hand of management in a big way as it goes all out on the vital job Donald Nelson has staked out for industry.

* * *

He has told us that if we are to make these ten silver months productive enough to make up for the golden months that are gone, industry must do things it never thought it could do. That is dead right. For America now finds itself in a position it never thought it could be in.

All too slowly, but very surely, it is dawning upon us that this is OUR WAR. Moreover it was our war long before we knew it or did much about it. So our job today is not merely to match the current production of our enemies. That is not enough. We must produce also enough to match the surplus of resources they had built up before we got started. We must produce enough not only for our own needs, but also for all the United Nations.

Moreover we must produce all that we need for *decisive* victory, for anything short of that will mean defeat. If we would save the American way of life, we must destroy once and for all the forces that threaten it. A stalemate would mean but an armed truce and what that might do to the American way of life and to American industry no one dares to guess. Victory must mean *decisive* victory. And this, very definitely is our war.

And just as definitely, this is OUR YEAR. For in this year – 1942 – we must prevent our enemies from achieving an advantage that might put victory forever beyond our reach – despite all our vast resources. It is an appalling fact that victory may slip beyond our grasp – not in 1943 or in 1944 – but during the months just ahead of us.

"Industry's responsibility in all of this is great," says Donald Nelson. "The job will take brains and initiative, but we can do it if we go out with a will."

To Mr. Nelson, that initiative means that industry must lead rather than follow in the march to more intensive use of our machines and our man-power. We dare not wait for new facilities to meet our mounting needs. More and more we must press for more widespread subcontracting and conversion. And he is counting on that initiative, backed by ever more aggressive effort, to avert or to minimize the compulsory measures that now seem imminent.

"We must stop thinking about what we're going to do to the enemy in 1943 and start thinking of what we're going to do to him in March of 1942.We must make today the things we would be making next year . . . if we had the time to spare."

That, says Donald Nelson, is the task of American industry during the next "Ten Silver Months." And to that gigantic task American industry now must bend every ounce of its abundant strength.

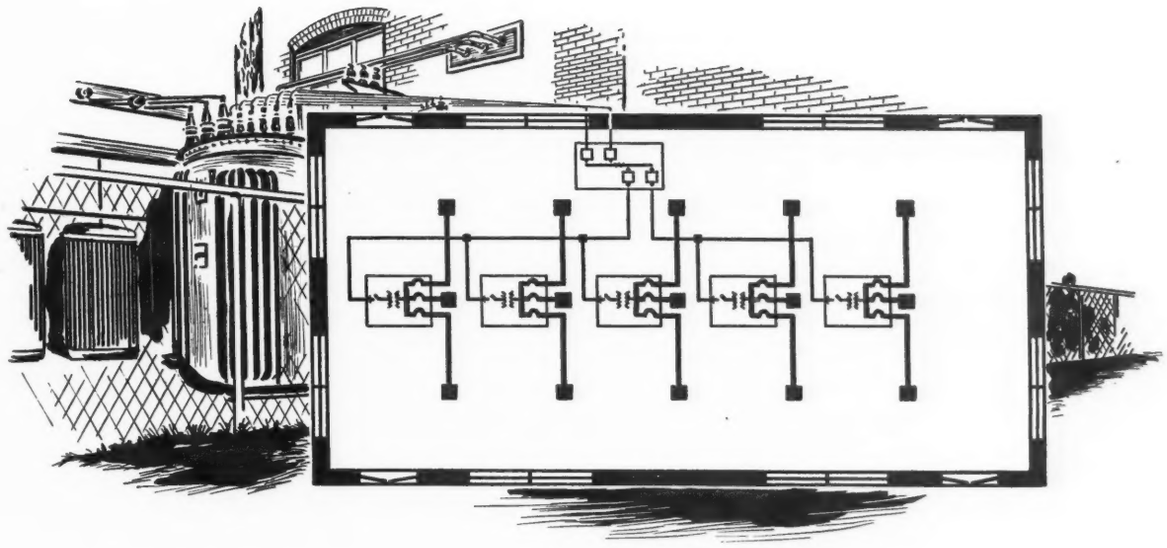
James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

POWER

Established 1882 • PHILIP W SWAIN, Editor



Better Electrical Distribution

This World War, like the first, is speeding up technical progress. A notable example is the recent rapid development and acceptance of radically improved systems for distributing electric power within factories, large buildings and institutions. See pages 56 and 114 for details.

The war effort creates grave shortages of copper, rubber, steel, all of which are conserved by the new systems. They meet other emergency requirements of these days by simplifying the ordering and installation of electrical distribution equipment, and by making it less important to guess correctly where and how much the load will grow. They insure a more uniform voltage at the consuming end. In most cases they increase service reliability.

What are the offsetting disadvantages of these new systems as compared with the old-line distribution throughout the factory at utilization voltage? The answer is that there aren't any disadvantages—not even a higher first cost; in general the first cost is less. Moreover the systems are not patented. Suitable equipment can be supplied by several different manufacturers.

All these are good reasons why every power man in industry should read the articles just mentioned. There he will find described the major forms of improved distribution systems, with comparative advantages and costs.

One common characteristic of all of them is primary distribution within the factory at a voltage higher than the application voltage. Commonly this primary distribution is at a potential between 2300 and 13,800 volts. The primary circuits may take various forms described as "radial," "loop" and "network," each with special advantages.

These circuits carry the primary voltage to various prefabricated "load centers" set directly on the factory floor or in other convenient locations. Each "load center" is normally a metal-enclosed unit combining the necessary switches and protective equipment with a transformer stepping down to the power utilization voltage—120/208, 220, 440 or 550. The resulting secondary circuits may be independent or interconnected in various ways.

All of these new load-center systems save copper and reduce transmission losses. The small prefabricated load-center units permit easy ordering and installation. Comparatively light and without foundations, they can be moved easily to other points if load growth in unexpected directions upsets the original plans.

To sum up, these distribution systems seem ideally suited to the requirements of emergency production and of ultimate peacetime operation.

Which Power-Distribution System?

Four industrial-plant electric power-distribution systems are described and compared, with an eye to installation cost, reliability, flexibility, voltage regulation and power loss in lines

► Plant expansions to meet the war effort make electric power-distribution systems a matter of rapidly increasing importance to industrial-plant engineers and operators. No industrial plant is more reliable than its distribution system, because on it depends every link in the chain of mass-production operations. Air-raid precautions add a new element—the problem of restoring service should part of the plant be damaged.

Several industrial distribution systems have been developed to meet requirements of power supply, size of plant, power load, load distribution, degree of reliability and flexibility, cost of installation, and voltage regulation. These include low-voltage radial, medium-voltage radial with transformers at load centers, medium-voltage radial with primary loop feeder, banked-transformer distribution with secondary loop feeders and the secondary network distribution system.[1]

Low-Voltage Radial System

Of these systems the low-voltage radial is the oldest and simplest. It consists of a low-voltage power supply connected to busbars on a switchboard from which feeders run to distribution panels at load centers, as in Fig. 2.

Power supply, Fig. 2, may be taken from a medium-voltage ac system, in which case it would come through a step-down transformer bank before being connected to the low-voltage switchboard busbars. Power may also be supplied from a low-voltage ac or dc plant.

Power is distributed by running one or more feeders from the low-voltage switchboard busbars to distribution panels at load centers, from which circuits radiate to individual loads, such as motors. If a large motor were on the system a feeder might run directly from the low-voltage switchboard to this motor, without going through a distribution panel. Where alternating current is available, the lighting load may be supplied from a feeder at power voltage run to step-down transformers at load centers. No matter how power is supplied, the principle of the simple low-voltage radial system remains essentially the same as Fig. 2.

For small plants operating at 600 volts or less the radial system, Fig. 2, has the advantage of simplicity and low cost. If properly installed, additional feeders may be added at normal cost without serious interference with power supply to other feeders. This system has the disadvantage that if the power supply to the low-voltage busbars fails, the whole system is down. A fault in a single feed will interrupt the power to the load supplied by that feeder. Voltage regulation at the different panels will vary with the length of the feeders and the loads on them. Voltage on long feeders will be lower than on short ones similarly loaded.

The simple low-voltage radial system, however, when properly designed, installed and maintained, has a high degree of reliability and is generally well suited to small plants. As plant size increases, the cost of copper in large long feeders, combined with large power losses and other factors, make other distribution systems more desirable and economical. One of these is a distribution system with radial primary feeders and step-down transformers in unit power distribution centers, Fig. 3.

This system is practically the same as Fig. 2 except that power comes into

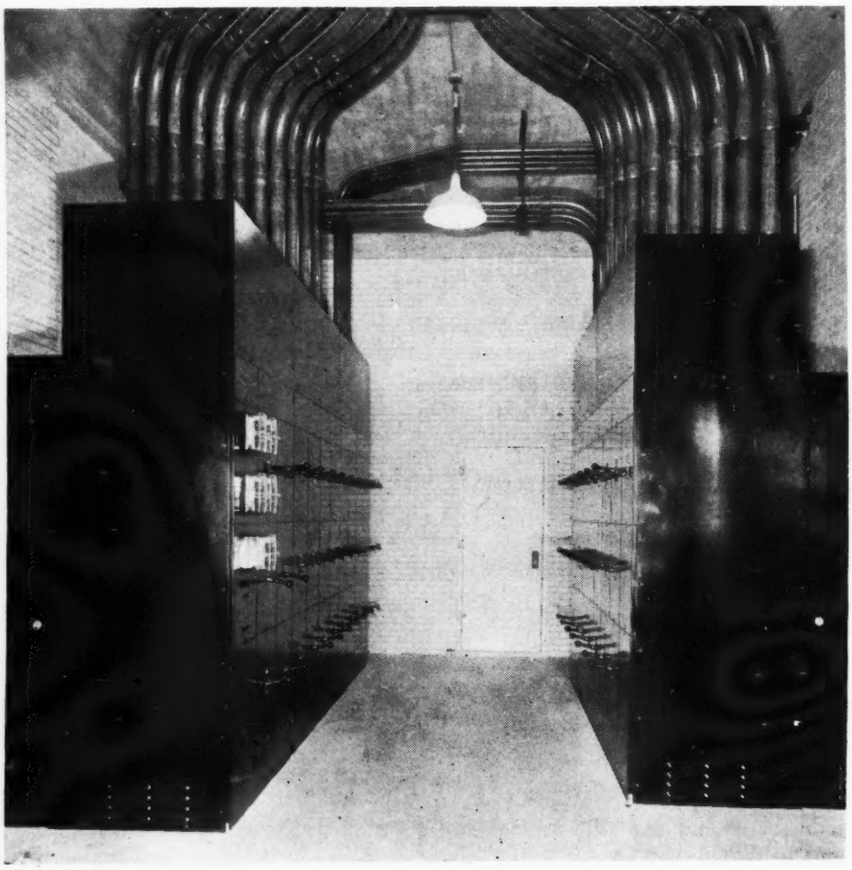


Fig. 1—Fifty-two 440-volt, 3-phase power circuits run from this dead-front industrial-plant switchboard supplied from three 500-kva step-down transformers

[1] Material for this article was supplied by the Westinghouse Electric & Mfg Co

the plant at 2300 volts or higher and is distributed to power centers at that voltage. At the power centers, transformers step the voltage down to that used for the power loads, usually 240 or 480 volts. These centers are comparable to the low-voltage switchboard, Fig. 2. From these power may be distributed directly to medium- and large-capacity motors or groups of medium- and small-size motors may be supplied by a feeder going to a distribution panel as at *A*. Lighting loads are supplied by feeders going to transformers that step the voltage down to lighting-circuit values, as at *B*.

For large plants the system, Fig. 3, usually costs less and has lower power losses than the simple radial system supplied from a single transformer or a low-voltage generating plant. Power-supply line faults interrupt all loads and a fault on any one of the feeders stops power supply to its load center the same as in Fig. 2.

In Fig. 3, additional feeder and transformer capacity can be installed in comparatively small increments, with little interference with the rest of the system. Voltage regulation is improved because the high-voltage feeders and the transformers are closer to the loads than in Fig. 2. Both lighting and power loads frequently can be served from the same secondary circuit without serious light flicker.

With radial distribution systems supplied by primary loop feeders and unit power centers, Fig. 4, the substation, with its oil switches and other equipment, Fig. 3, is eliminated. Otherwise the two systems are practically the same. All unit power centers with transformers are tied together by a loop feeder. To take full advantage of this system the loop feeders must be large enough to transmit the total power load in either direction from incoming feeder to system.

Primary Voltage

Where 2300 volts is commonly used with the system of Fig. 3, a higher voltage, such as 6600, should generally be used on the loop feeders of Fig. 4, because they must have more capacity than the radial feeders. A switch in each power unit permits disconnecting any section of the loop feeder from the system in case of trouble. For example, a fault at *X* can be removed from the system by opening switches *A* and *B*. This interrupts service to power center No. 3 but the faulty circuit can be disconnected at this center and the load picked up again by closing switch *B*. Power is then fed to No. 3 center through the switches in No. 1 and 4 power centers. Faults in a power-center transformer or on the busbars only interrupt the power supply to the load they serve, as with the radial system with primary feeders.

From the power centers of the loop-feeder system, Fig. 4, circuits for light and power are run as in Fig. 3. The problem of expanding the system to supply increased load is practically the same as for Fig. 3. The primary loop arrangements will cost less than the radial primary feeder system, because the high-voltage switchgear has been eliminated except on the incoming circuit or circuits. This has the lowest installation cost of all the radial distribution systems and when properly designed gives good voltage regulation. It is therefore particularly suited to conditions where low installation costs and good voltage regulation are of prime importance.

Banked-Transformer System

A banked-transformer distribution system, Fig. 5, has a secondary loop which is supplied from a primary loop as in Fig. 4. In this system a banked-transformer unit consists of a 3-phase transformer, a primary and secondary switch or non-automatic circuit breaker. The switches permit isolating a section of the primary loop feeder

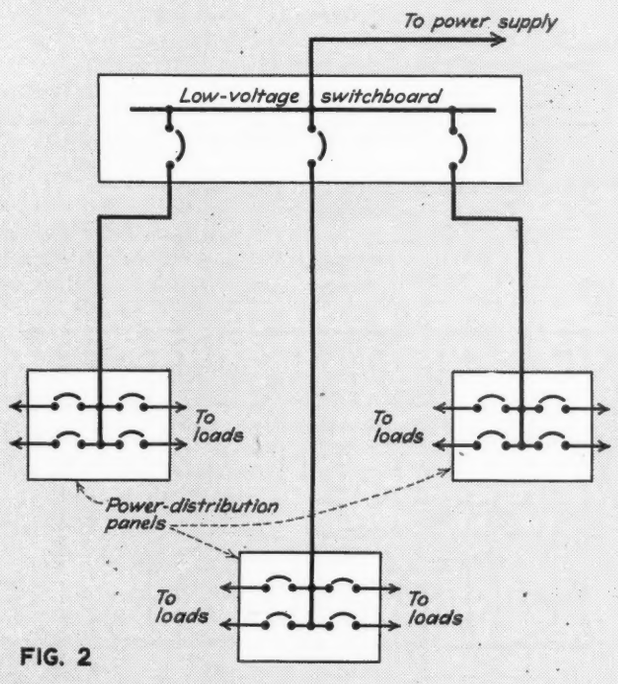


FIG. 2

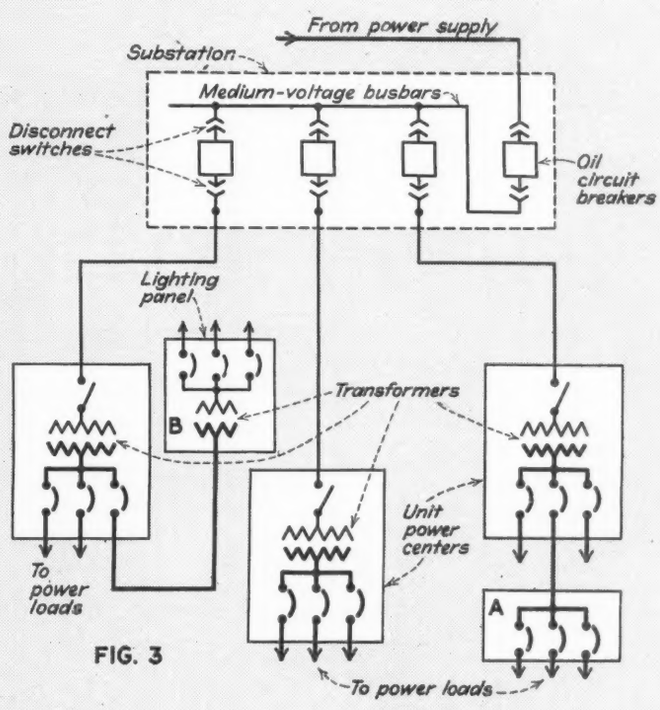


FIG. 3

Fig. 2—Low-voltage radial distribution system supplied from a single power source. Fig. 3—Medium-voltage distribution system with radial feeders and step-down-transformer unit power centers

or a transformer that may be faulted. Because it may be necessary to carry all the load in one direction in the loop its conductors should be designed to carry the total system load.

The secondary loop, Fig. 5, ties all the load-center busbars together so that power may be fed from any transformer unit on the system into any load center and thus increase reliability. Up to the load centers the low-voltage conductors are protected by limiters, which are fusible copper links designed to give protection against short circuits. So that only the faulted section of the secondary loop will be isolated in case of a short circuit two or more conductors must be used in each phase of the circuit.

The primary loop feeder, Fig. 5, serves the same purpose and is operated in the same manner as the one in Fig. 4. Normally the primary loop and all other switches are closed to tie the whole system into a single network. Power is supplied through all the transformers to the low-voltage or secondary loop, where it is distributed through panels or other forms of distributing centers to the loads.

If a fault occurred in the loop feeder or in a transformer it would interrupt the service temporarily by opening the supply feeder breaker, but could be cleared quickly from the system. Assume a fault in primary loop feeder *B*. Then by opening switches *S* and S_1 and circuit breaker S_2 this feeder and transformer No. 3 is removed from the system. After this is done service can be restored immediately and power supplied to limiter box *L* through the secondary loops connecting this box to the rest of the low-voltage system. A fault in any part of the low-voltage network will be cleared by opening a limiter or limiters without interrupting any load even temporarily, except on the faulted load cable.

Large-Plant Systems

Like the radial distribution system with primary loop feeders, the banked-transformer system is intended for large plants. Its cost is slightly higher because of the secondary-loop feeders, but it provides greater flexibility than the radial system with primary loop. Load growth or system changes can be accommodated with minimum interference to operation. Because of the secondary loop, reliability is high and uniform voltage regulation is obtained.

Excess transformer capacity on one part of the system is immediately available to supply load in parts where the load may be in excess of transformer capacity. For this reason, less transformer capacity may be required for a given load than with the systems of Figs. 3 and 4. Power and light can be supplied from the same secondary circuits, because flicker is reduced to a minimum. Because of the primary and secondary loops, circuit conductors can be arranged for uniform load distribution and to keep power losses at a minimum. The primary loop also brings the high voltage close to the load centers and reduces power losses.

In the banked-transformer distribution system, Fig. 5, the secondary loop is similar to that used in the network distribution system, which will be described in a subsequent article by H D James, consulting engineer of the Westinghouse Electric & Mfg Co. This facilitates changing the banked-transformer to a network system whenever a second primary feeder is available or whenever higher reliability and flexibility than that afforded by the banked-transformer system becomes necessary.

Fig. 4—Radial power-distribution system with primary loop feeder and step-down-transformer unit power centers. Fig. 5—Distribution system with primary and secondary loop feeders interconnecting banked-transformer units

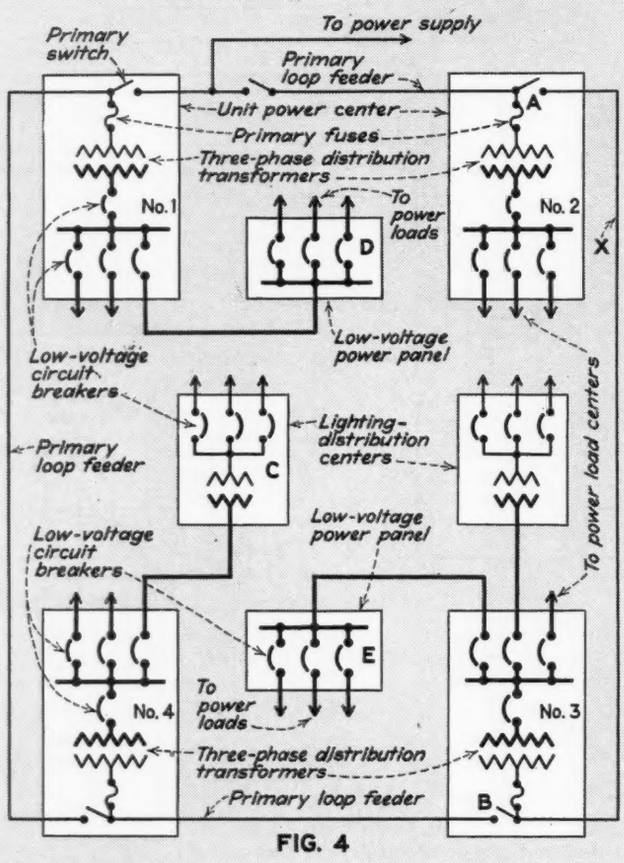


FIG. 4

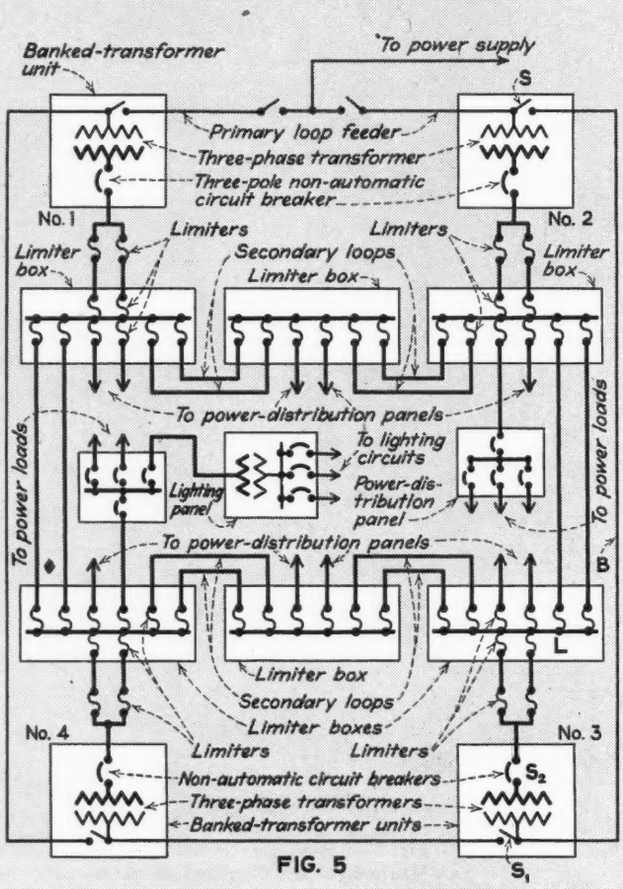


FIG. 5

Governing Turbine Pressures—II

Complicated central-station superposed-unit arrangements require intricate governing systems for adequate protection. Mr Sheppard continues from February POWER his survey of turbine-governing for multi-pressure installations

► WHEN low-pressure boilers of a superposed plant are shut down cold or are banked so that their nonreturn valves are shut, the stabilizing influence of the large mass of water in older varieties of generously proportioned drums is absent. Maintaining constant pressure on the intermediate header becomes a problem of balancing flow.

Unless some form of pressure governing is used, the attention of the switchboard operator must be directed constantly to correcting high-pressure turbine flow by its speed governor. He must keep pressure between the popping point of low-side safety valves and the reducing-station cut-in value.

Fig. 1 represents a usual arrangement of a superposed plant without low-pressure boilers. A backpressure governor controls the high-pressure turbine, the speed governor of which is inactive at all ordinary frequencies. Station load is varied by adjusting the speed governors of the low-pressure machines. Load changes result in variations in high-pressure turbine flow as the backpressure governor attempts to maintain substantially constant pressure in the intermediate header. This system, now in use in quite a number of superposed plants, generally meets all operating situations except sudden decrease of high-pressure steaming rate.

Reduced Output

If boiler output is suddenly reduced, the backpressure governor and the pressure element of the reducing station both attempt to pass more steam and thus cause boiler pressure to fall rapidly. Opening the valves holds up intermediate-header pressure longer at the expense of added difficulty with the boiler. If boiler pressure is to be held anywhere near normal during such faults, the operators must be prompt in reducing loads on low-pressure units.

The primary shortcoming of the apparatus in Fig. 1 can be overcome easily by adding initial-pressure regulators to each of the low-pressure turbines as shown in Fig. 2. These latter are normally inactive and allow the speed governors to function as usual except when boiler output is insufficient and boiler pressure falls to, say, 90% of normal. Then the regulators step in and take precedence to start closing the low-pressure turbine valves.

When a balance exists that the boiler can supply, the reduction in low-pressure turbine load promptly causes the backpressure governor to close the high-pressure turbine valves part way, checking further decline in boiler pressure. Intermediate-header pressure remains exactly normal and hence steam supply for auxiliaries is assured.

This system also gives adequate protection to the intermediate-header supply in event the high-pressure generator switch trips out. Low steam pressure on the intermediate header causes immediate opening of the reducing sta-

The Governing of High-Pressure Turbines —by W Guilhauman, AEG—Mitteilungen, December, 1939, No. 12
Recent Developments in Turbine Governing—by R J Caughey, Combustion, June, 1940

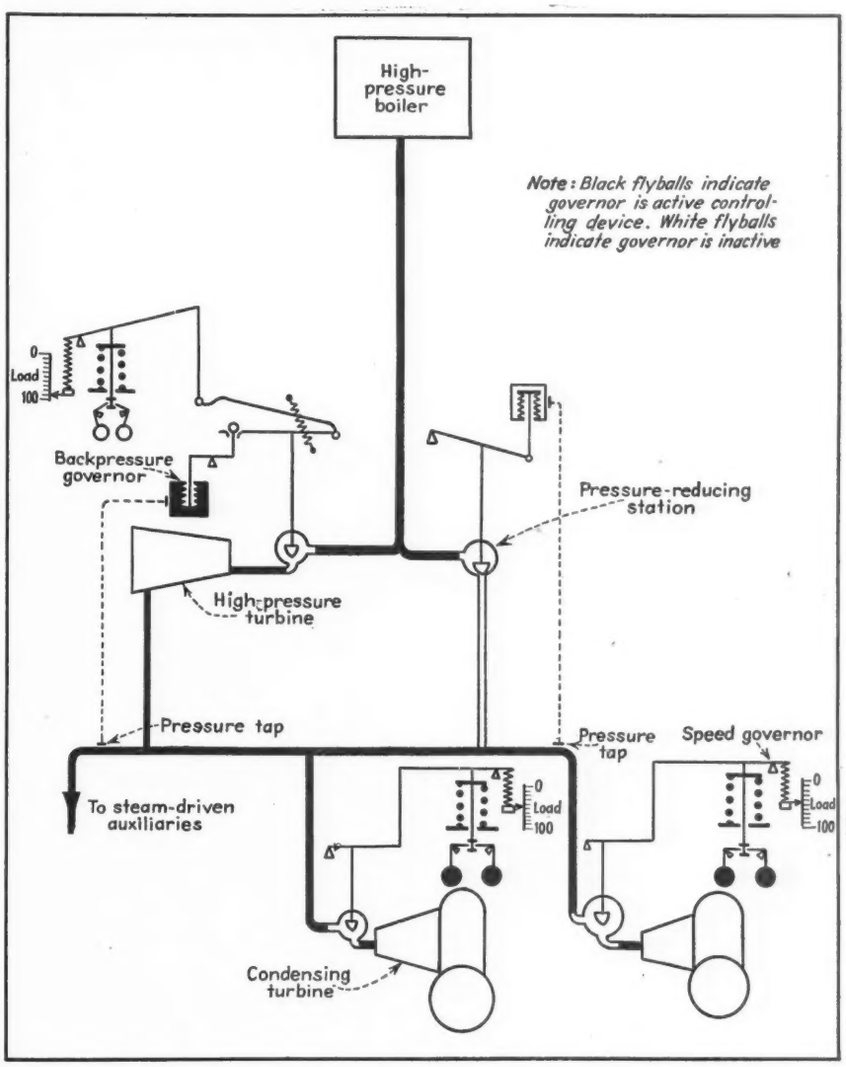


Fig. 1—If no low-pressure boilers are operated, high-pressure turbine is governed by backpressure unit; reducing valve provides standby protection for condensing units

tion. Initial-pressure regulators cause no interference since boiler pressure tends to rise on trip-out of the high-pressure unit.

Protection is also afforded in the event of tripping one or more of the low-pressure generator switches. The intermediate-header pressure tends to rise and the backpressure governor closes the high-pressure turbine valves. Combustion control, of course, must function rapidly enough to reduce boiler output if safety valves are to be prevented from blowing. Note that the initial-pressure regulators on the low-pressure turbines are connected to and actuated by boiler pressure.

Plant additions in partially topped stations tend toward a minimum of high-pressure steam interconnections to reduce initial investment. If a connection is made between high-pressure boilers, the control arrangement of Fig. 2 is applicable. However, if no tie is installed, somewhat more complicated controls are required to obtain the following objectives:

(1) Opening one or more low-pressure generator switches should result in substantially constant header pressure and high-pressure turbines should automatically reduce their flow accordingly

(2) Opening one of the high-pressure generator switches should interfere in no way with loads on the low-pressure machines; that is, the reducing station on the affected high-pressure boiler should open promptly so as to keep the total steam flow to the low-pressure header undiminished.

(3) In no case should a pressure-reducing station open if the low-pressure header is at normal pressure, nor should a reducing station try to put steam into the header if its corresponding boiler is already in distress

(4) Sudden loss of steaming ability of one boiler should automatically unload its high-pressure turbine to keep its pressure almost normal; neighboring high-pressure turbines should automatically pick up any remaining capacity they have and, finally, if there still remains a deficiency of steam for low-pressure units, they should automatically unload to keep header pressure up to normal for steam-driven auxiliaries.

While the number of central stations with two or more topping turbines is limited, their problems are of general interest to others who may sometime contemplate additions to plants that are already topped. A control arrangement typical of multi-top plants is shown in Fig. 3.

Since the controls would vary slightly for different plant arrangements, several assumptions have been made for Fig. 3. Boiler pressure is nominally 1200 lb and safety valves start lifting at 1400 lb. Automatic boiler controls are fast enough to keep swings between limits of 1100 to 1300 lb during all moderate load changes provided, of course, that demands remain within the capacity of the boiler. Speed governors on the high-pressure turbines remain inactive and are used only as pre-emergency devices. Backpressure governors normally control steam flow and all are paralleled. They can maintain 190–200 lb. High-pressure turbines each have an initial-pressure limit governor which allows the backpressure governor full control so long as boiler pressure remains above 1100 lb. Any tendency for pressure to fall below this value causes the respective initial-pressure limit governor to step in and take control away from its backpressure governor. The reducing station is normally kept shut by two pressure elements, one connected to the low-pressure header and the other to the boiler pressure. The former keeps the valve closed for header pressures above 190 lb, but will try to open the valve if pressure falls below this value.

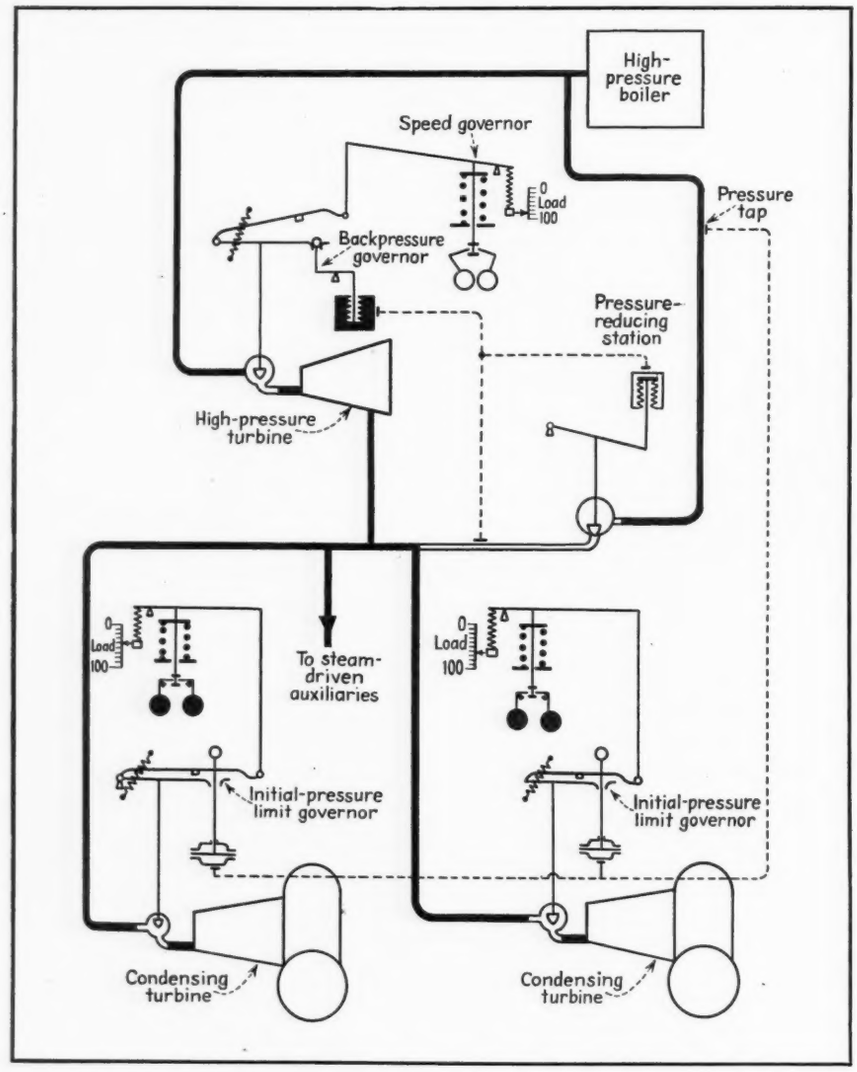


Fig. 2—Initial-pressure limiting governor steps in to take over control only if boiler pressure falls below 90% of normal, indicating that boiler cannot carry load

Limited Action

The reducing station will open at pressures below 190 lb only in the event that its related boiler pressure is 1300 lb or more. The lever-interlocks diagrammatically represented in Fig. 3 indicate how this is accomplished. The low-pressure turbines are each normally controlled by a speed governor which has full control so long as the header pressure remains above 180 lb. Any tendency to fall below 180 lb causes initial-pressure regulators on low-pressure turbines to close control valves part way.

This particular arrangement is only one of many possible. This scheme,

however, does avoid instability and interference between one control and the others. Objectives outlined above are accomplished with precision and speed.

Consider a typical emergency that can occur. Assume that the generator switch of low-pressure unit No. 1 opens. Pressure in the 200-lb header will tend to rise and the backpressure governors will promptly reduce their respective flows to maintain 200-lb pressure. If boiler controls are not fast enough to keep pressure from overshooting 1300 lb, the high-pressure elements of the reducing stations will try to open their respective valves but will be prevented from doing so by the low-pressure elements preventing valves from opening while header pressure is above 190 lb.

Turbine Shutdown

Another contingency is the opening of a high-pressure-unit generator switch causing turbine *B* to close its valves suddenly. Turbine *A* takes load up to the limit of its capacity because it is under control of the backpressure governor which is trying to maintain pressure in the 200-lb header. Assume that the total flow through *A* is insufficient to hold 190 lb. Immediately the 190-lb elements on the reducing stations try to open their respective valves. Only station *B* opens, however, because boiler *B* is the only boiler in which pressure rises to 1300 lb.

Since the plant is without turbine *B*, either the boiler operator must switch the combustion control to manual operation or an auxiliary contact on generator breaker *B* should automatically make the transfer. After control is taken away from boiler pressure, any required amount of steam can be delivered through the reducing valve by holding pressure above 1300 lb to keep the "spillover" control element of the reducing station in the open position.

Next consider what happens when boiler *B* loses 50–75% of its steaming capacity due to loss of a pulverizer or similar auxiliary trouble. The backpressure governor on turbine *B* tries to open with the result that pressure quickly falls from 1200-lb normal to 1100 lb. The initial-pressure limit governor on turbine *B* takes control away from the pressure governor and moves valves toward the closed position until decline in boiler pressure is checked. Reducing station *B* cannot open because its "spillover" element will not open at 1100 lb.

The resulting loss of steam flow from the *B* section of the plant obviously is more than turbine *A* can pick up. Pressure in the intermediate header sags to 180 lb but neither reducing station

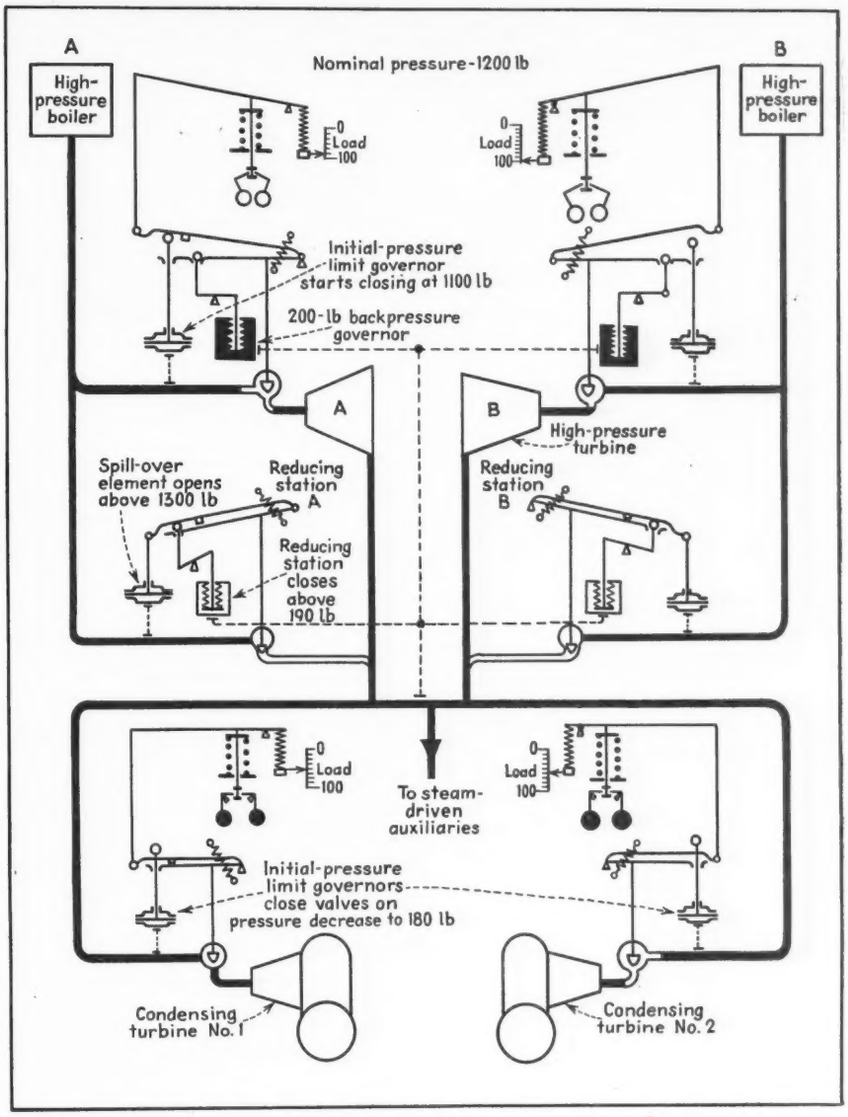


Fig. 3—If two or more topping turbines exhaust to a common low-pressure system, governor arrangement must meet many contingencies in rapid sequence

opens. The load on low-pressure turbines is then automatically reduced by initial-pressure limit governors until header pressure is maintained at 180 lb, assuring steam for auxiliaries.

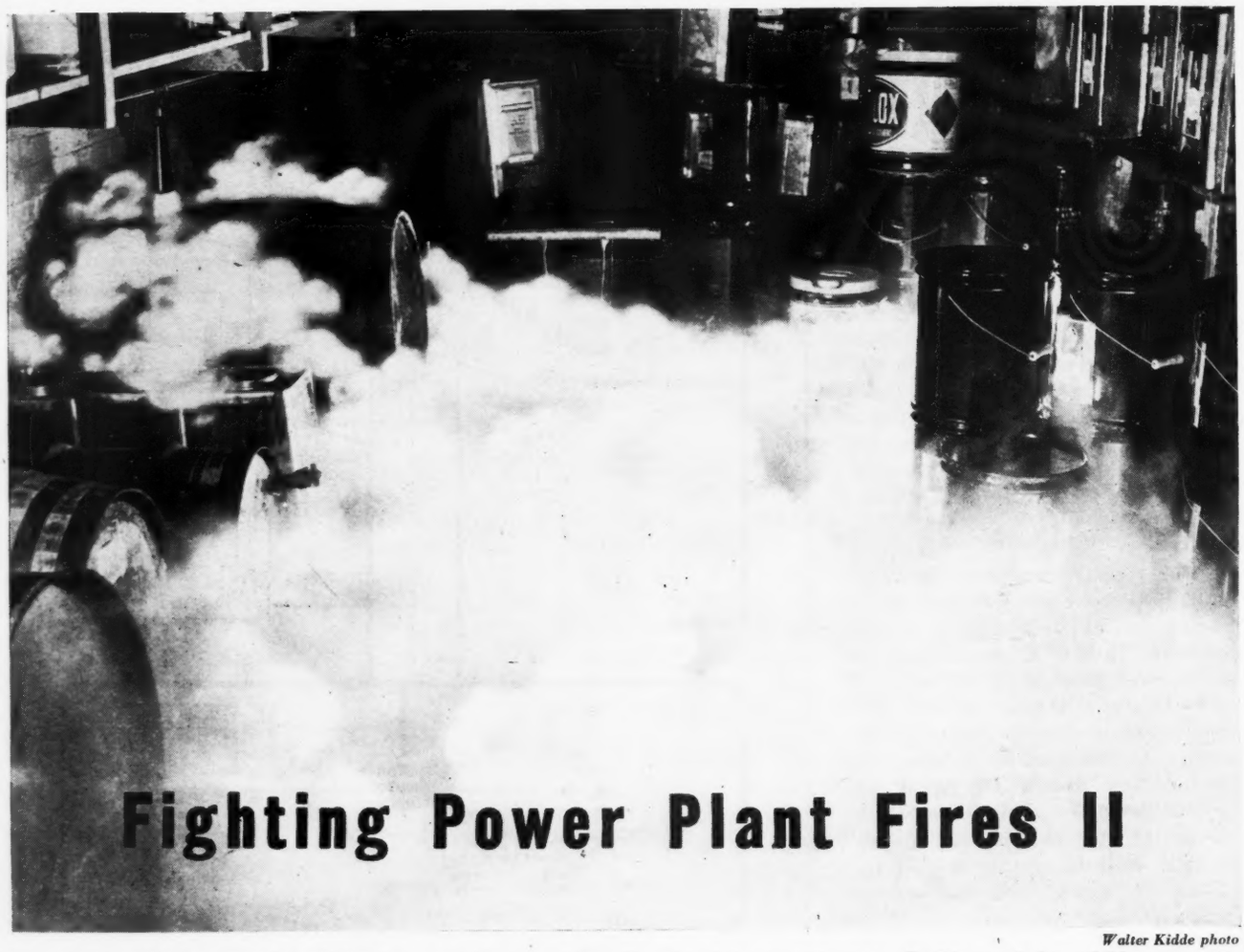
These several schemes are typical of plants now in service and give a picture of controls which are available. Many variations are possible from the apparatus arrangements described. Some have been perfected that involve quick-opening valves in series with the reducing stations and constant positioning of the reducing-station valve stem proportional to the turbine steam flow. Other arrangements snap open reducing stations by indications of turbine throttles being shut or generator switches opening. These and many other special cases have ingeniously met local problems.

✦ ✦ ✦

Bomb Sandbags Block Air Intake

A recent report from an engineer in Scotland calls attention to the fact that the placement of sandbags or other protection around basement openings can be carried out so completely as to block the supply of air for combustion. Several such instances have resulted in reduced capacity of firing equipment.

While American plants are now more concerned about blackout precautions, overzealous protective measures may easily result in similar reduction in plant capacity. Best suggestion offered on the basis of British experience is the construction of brick walls a sufficient distance apart to form an effective air duct. At right angles to a door or window, these form an obstruction that keeps light in and bomb débris out if the latter contingency occurs.



Fighting Power Plant Fires II

Walter Kidde photo

Fig. 1—Potential fire hazards, existing in every plant, are the oil and paint storage rooms. Positive and dependable automatic equipment protects rooms that remain unattended for any length of time

W E Rossnagel continues his instructions on fire fighting, covering class B fires and the methods used in combating them with both fixed and portable extinguishing devices

▶ IN THE PRECEDING ARTICLE of this series (POWER, November, 1941, pg. 76) we discussed class A fires, or those occurring in ordinary combustible materials such as wood, paper, rubbish, and rags. This article will deal with class B fires, or those occurring in inflammable liquids.

The most effective means of extinguishing fires in oils, paints, greases and certain chemicals is by excluding air, or by cooling below ignition temperature. The oldest and simplest method of extinguishing small fires is by sprinkling with sand, bicarbonate of soda, or other approved powdered or granulated materials.

The first real advance in fighting class B fires came with the introduction of the self-generating pressure fire extinguisher. Foam and soda-acid extinguishers operate through chemical reaction resulting when the apparatus is inverted. The main body of the foam extinguisher is filled to the proper level with a solution of sodium bicarbonate and a proprietary foam-producing agent in water. An inner cylinder or chamber contains a water solution of aluminum sulphate. The chemical reaction resulting when these solutions mix produces 20 gallons of thick foam from the 2½-gal extinguisher and 320 gallons of foam from the 40-gal unit. The pressure developed during the reaction forces the foam through the hose and nozzle. Externally, foam extinguishers appear almost identical to the soda-acid unit. However, the nozzles of the foam extinguishers have orifices about twice the diameter of those on the soda-acid units. If the soda-acid nozzle is used on a foam extinguisher, excessive internal pressure will break down the bubble structure, or possibly clog the orifice. On the other hand, should the foam nozzle be used on a soda-acid extinguisher, pressure developed will be insufficient to throw the stream the required distance. Foam extinguishers like soda-acid units, must be protected from freezing and must be recharged annually.

For more serious fire hazards separate foam generators are installed and their discharge piped directly to the equipment to be protected. In this system discharge nozzles are arranged so that the discharge is evenly distributed for maximum effects.

Vaporizing-liquid (carbon tetrachloride) extinguishers in sizes ranging from one pint to 3½ gal are acceptable for use on class B fires where the quantity of flammable liquid is not too great. The three smallest sizes are hand pumped while the larger sizes are operated by stored-up air pressure. The carbon tetrachloride should be directed across the surface of the burning liquid or at the wall of the tank just above the liquid. Heat causes the extinguishing liquid to vaporize, with

the result that the dense fumes produced will blanket the burning liquid and put out the fire. When used in confined locations such as small rooms the toxic fumes may cause asphyxiation or poisoning of those exposed to them. Gas masks should be worn under these conditions.

No periodic recharging of vaporizing liquid extinguishers is necessary, but when required, it is important that the liquid be secured from the equipment manufacturer as the commercial grade of carbon tetrachloride may cause corrosion of the extinguisher parts. It is also essential that the liquid be kept free from water or moisture. Hand-pumped extinguishers should be kept in working order by occasionally moving the handle to prevent it from sticking. The surface of the liquid in the larger sizes should always be visible in the sight glass, if one is provided, and the air pressure should be maintained at the recommended point.

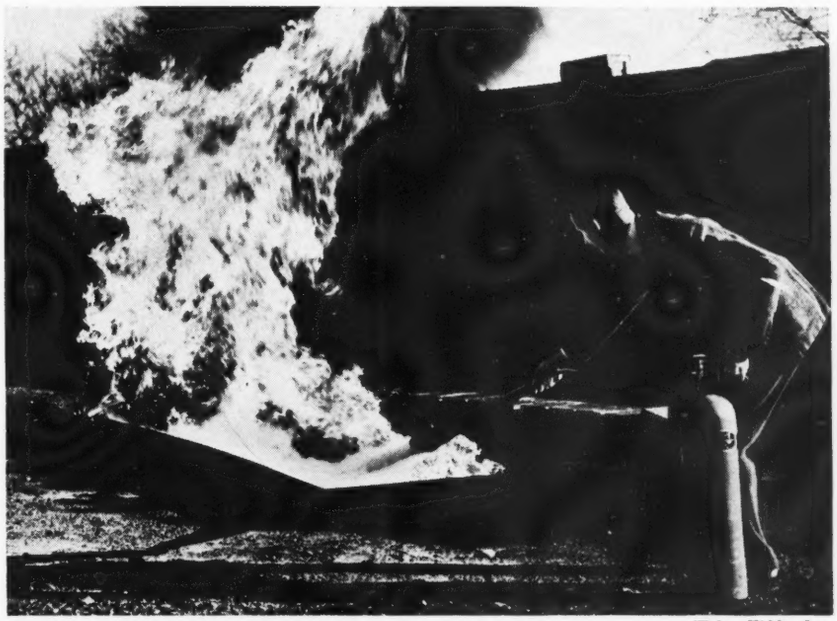
When using self-generating pressure or vaporizing-liquid extinguishers the discharge must be directed so that the surface of the burning liquid is not disturbed.

CO_2 extinguishers varying in size from 7½ to 50 lb may be used, the size depending upon the particular hazard involved. Each pound of liquid will produce approximately nine cu ft of gas when released to atmosphere. The CO_2 cylinders when fully charged have a pressure of about 750 psi, which pressure is held by a thin metallic sealing disk. When this seal is once punctured, the extinguisher should be recharged and new seal inserted. The valve will hold the pressure until the extinguisher can be recharged. The only servicing required of CO_2 extinguishers is to weigh them once a year. The weight should be the same as that recorded by the manufacturer, but to allow for variations in the accuracy of the different scales, it is customary to recharge the extinguisher when its weight is 10% less than the initial weight as recorded on the container.

To operate a CO_2 extinguisher, withdraw the locking pin by breaking the wire seal, and turn the valve wheel which operates a cutter to pierce a sealing disk in the valve body. When discharge takes place, the liquid changes to the gaseous state as it passes into the nozzle. In the diverging nozzle, the gas expands rapidly, this expansion being accompanied by the absorption of heat to the extent that the CO_2 issues in the form of a dense cloud of snow at a low temperature. Direct this cloud of CO_2 at the burning liquid in a slow sweeping motion, blanketing it and excluding air. The low temperature has comparatively little effect on the fire other than cooling the hot surface so as to prevent reignition.

It is important that the discharge nozzle be held by the handle as the intense cold of the metal parts will injure the skin. Also, those using CO_2 extinguishers are cautioned against handling the accumulations of snow which may be found after the fire is extinguished.

For more serious hazards, stationary CO_2 systems are sometimes installed, 50-lb cylinders being grouped and connected to a manifold. The piping leads to expanding nozzles properly located over or near the equipment and directed downward. The cylinder valves may be remote controlled by a manual trip, or by temperature control. Such rooms should have automatic fire doors and shutters to confine the CO_2 and the products of combustion.



Walter Kidde photo

Fig. 2—Break the extinguisher sealing wire and remove the valve locking pin. Grab the nozzle in your right hand, picking up the extinguisher in the left. Move up to the fire, set the extinguisher down and aim the nozzle at the fire while you open the valve with your left hand. Make every bit of gas count by applying it judiciously

Walter Kidde photo

Fig. 3—Aim the nozzle at the base of the fire, moving it back and forth to drive the fire back. Continue to force the flames back until the last trace of fire disappears

Atomized Water

Perhaps the most recent development in equipment for fighting fires is the fire-spray or fog nozzle. It has long been common belief that water should never be used on an oil fire, but recent tests have proven that finely atomized water is effective for class B fires. Usually the time elapsed between spray-

ing the water through nozzles and extinguishing the fire is counted in seconds rather than minutes.

The spray or fog-nozzle system can also be installed as permanent protection for large inflammable-liquid containers or storage rooms. In this case the nozzles are arranged and directed so that the discharge will cover the locations most likely to catch fire. Spray-nozzle adaptations will be discussed in a subsequent article.

Conserve the Supply

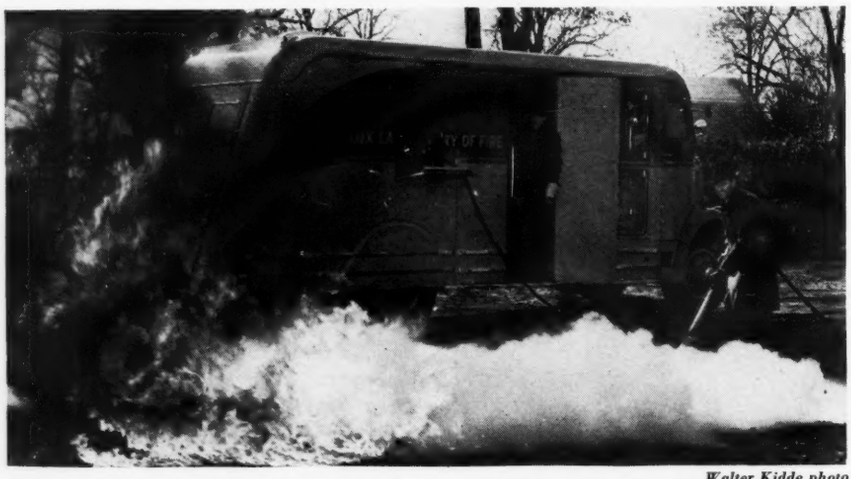
When using water under pressure an adequate supply is usually available and the small amount of water wasted is considered of no consequence. On the other hand, when a portable extinguisher of either type is used the supply is limited and must be applied accordingly. Even though the fire is extinguished, do not discharge the extinguisher to waste if it is equipped with a shut-off, as the fire may reflash

Board of Underwriters photo

Fig. 5—Direct the stream from a vaporizing liquid extinguisher against the wall of the container so that the stream is broken up. The liquid will then flow over the surface and be vaporized

Walter Kidde photo

Fig. 4—A vertical fire must be attacked at its base. Heat of the fire will cause the gas to rise. When the base fire is extinguished, direct the nozzle against the top fire



Walter Kidde photo

Fig. 6—Large fires require large quantities of extinguishing agent. Keep a supply on hand sufficient to extinguish the most severe fire which might be encountered

before additional extinguishers can be secured. It is always a good policy to have additional extinguishers delivered to the fire so that an adequate supply is at hand to combat the blaze.

When confronted with a fire, keep calm, marshal your forces, gather the available extinguishers and arrange for more to be delivered; then approach the fire with a well arranged plan of action. Get as close to the fire as possible and apply the extinguishing agent in the most efficient manner for the type of extinguisher being used. Serious fires can be averted by the quick and efficient use of a portable extinguisher before the fire gains headway.

A future article will discuss class C fires and other fire-fighting methods.

Know Your Planetary Gears

W F Plume, Philadelphia Gear Works, explains how single, compound and double planetary sets operate, and what design conditions must be met for successful application

▶ MODERN GEAR SPEED REDUCERS are built in many forms, using a wide variety of gears to meet practically every kind of power-transmission and speed-reduction application. Of the several types of gearing, the planetary finds extensive use for certain drives.

Planetary-gear systems are made up of spur, helical, and in some special cases, herringbone gears. Simple planetary sets consist of a sun pinion driving several idler gears mounted in a spider, inside a fixed internal ring gear meshing with the idlers, Fig. 1. The output shaft is part of the idler spider and the 3-idler system is the most widely used. The design in Fig. 2 shows all the rotating elements mounted on anti-friction bearings and built into a gearmotor.

In Fig. 2, sun pinion S is mounted directly on the motor shaft, which is supported in ball bearing B. One of the three idler gears is shown with its two ball bearings B_1 supported in the cage or spider which rotates in two roller bearings B_2. The idler gear meshes with internal ring gear R. As the sun gear rotates it turns the idler gears and they, with the spider, travel around inside the ring gear to rotate the output shaft. An individual planetary-gear unit is practically the same as Fig. 2 except that the input shaft with its sun pinion is supported in two bearings in the casing.

Fig. 3 shows a double-reduction planetary unit built as part of a gearmotor. The first-reduction, or high-speed end, of this unit is like Fig. 2, but the output shaft from the idler cage has a sun pinion S_1 on its left-hand end and is supported in ball bearings B_2. Sun pinion S_1 meshes with three idlers that in turn mesh with ring gear R_1. The idler-gear spider and output shaft are supported in two roller bearings B_3. This leaves the whole gear system free to be rotated by sun pinion S on the motor shaft.

In a third planetary-gear combination, Figs. 4 and 5, the sun pinion meshes with the idler gears as in the other systems. The idlers, however, have an idler pinion fixed to them that meshes with a ring gear of smaller diameter than for the single- or double-reduction units. This permits speed ratios not possible with either the

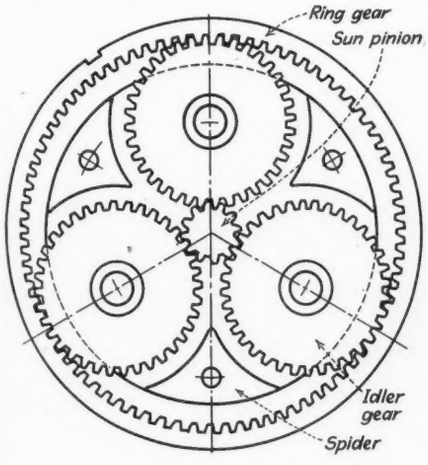


Fig. 1—How sun pinion, idler and ring gear mesh in a planetary system

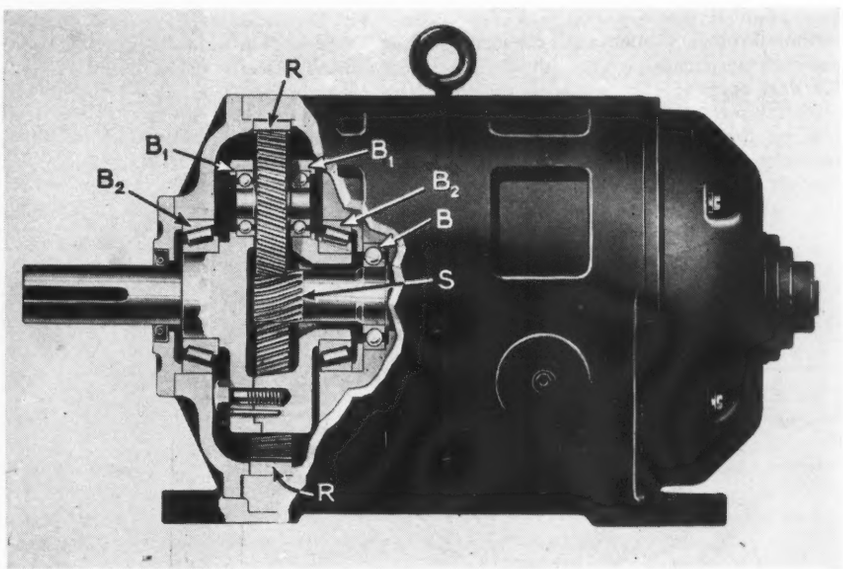


Fig. 2—Three-idler single-reduction planetary gear built as part of a gearmotor

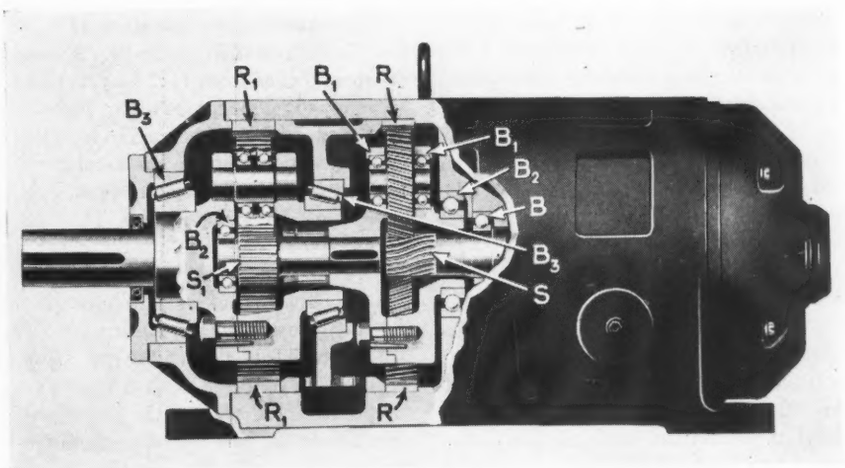


Fig. 3—Double-reduction plentary gear built as part of a gearmotor

single- or double-reduction designs.

The number of idlers vary from one to six, but three represent most common practice for commercial speed reducers. The number of reductions in a single unit may be as high as three or more where very high speed-reduction ratios are needed.

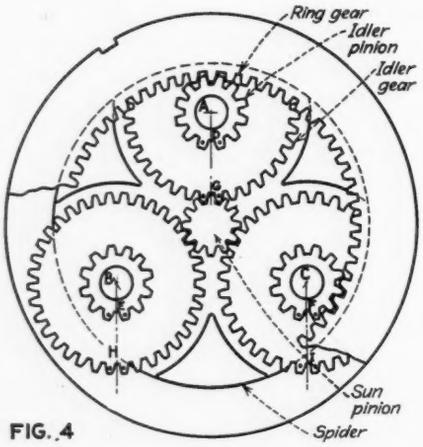


FIG. 4

Fig. 4—How sun pinion, idler gears, idler pinions and ring gear mesh in a compound planetary system. Fig. 5—Cross-section through a compound planetary-gear set. Fig. 6—Non-planetary system using three simple gears and pinions placed 120 deg. apart to give a straight-through drive. Fig. 7—Non-planetary-gear system similar to Fig. 6 but using an internal gear on the output shaft. Fig. 8—Simple pinions and gears arranged to give straight-through drive. Figs. 9, 10—Operation of simple pinion and gear.

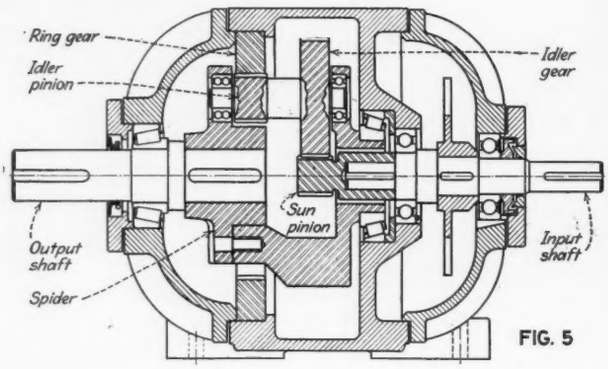


FIG. 5

three or four idlers and pinions are sometimes equally spaced around the input pinion and output gears. When only one idler gear and pinion are used they are generally fixed to their shaft and the shaft supported in bearings held in the gear casing, Fig. 8. In Fig. 7 the idler pinions *P* mesh into an internal gear *R*, instead of an external gear G_1, Fig. 6.

Because of the gear arrangements, the planetary system cannot be designed for as low speed ratios as can simple pinion and gear units, which may be as low as 1:1. On the other hand, higher speed ratios can be obtained with single-reduction planetary systems than with a simple gear and pinion. Speed-ratio limits of single-reduction planetary units for industrial work vary from 4:1 to about 11:1, but these are sometimes exceeded.

limits the speed ratio to about 100:1 instead of 121:1.

Planetary gearing involves several relations not found in the meshing of a simple pinion and gear. Any practical number of teeth in a pinion can be designed to mesh with any number of teeth in a gear. This is not so with planetary gears that have more than one idler. In Fig. 1, the sun pinion and the ring gear mesh with each idler gear. This makes it necessary for the number of teeth in these gears to have a definite relation or they will not fit together properly.

In a simple planetary gear consisting of three equally spaced idlers, this relation requires that the sum of the teeth in sun pinion and ring gear must be divisible by three. This relation holds whether the number of teeth in the idlers is even or odd, but involves

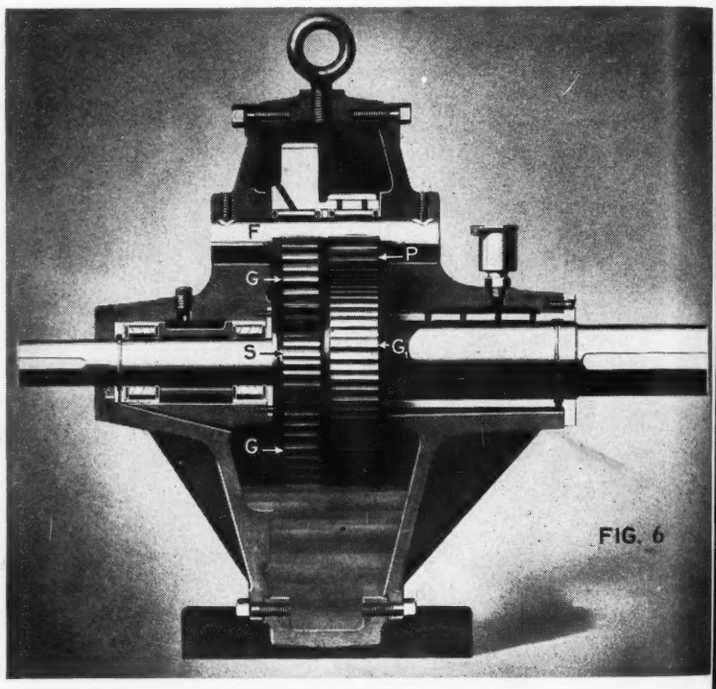


FIG. 6

Here it might be well to make clear the difference between planetary and non-planetary gear systems. Sometimes to get a straight-through drive, that is, one in which the axis of the input and output shafts are in the same straight line, non-planetary systems, Figs. 6 and 7 are used. In the system, Fig. 6, pinion *S* on the input shaft meshes with three idler gears *G* that rotate on fixed shafts *F*. A pinion *P* attached to each idler gear meshes with the output-shaft gear G_1. This unit is more generally built with only one idler and idler pinion, Fig. 8. However, to eliminate radial thrust on the meshing gears on the input- and output-shaft bearings and to obtain a more compact unit

When two simple planetary sets are used in combination, as in Fig. 3, overall speed ratios from 16:1 to 121:1 can be obtained. This leaves a gap between 11:1 and 16:1 which cannot be filled by a practical simple planetary set. The compound-planetary system, Figs. 4 and 5 produces these ratios. The compound system can comfortably cover a speed-ratio range of 8:1 to 25:1. The three common types of planetary gearing then are the single, covering ratios of 4:1 to 11:1, the compound, from 11:1 to 22:1, and the double, from 22:1 to 100:1. These speed-ratio ranges will vary somewhat with different manufacturers. In the double unit the second drive usually has a coarser pitch which

only the design of the gears and the system. The sun pinion can be assembled in any position since the gear spaces automatically line up when the idlers mesh with the ring gear.

A compound-planetary gear presents a more complex problem that involves not only correct gear design but also accurate timing. Fig. 4 shows a compound unit with three equally spaced idlers. The idler gears mesh only with the sun pinion and the idler pinions mesh only with the ring gear. The gear combinations must be such that when the idler gears mesh correctly with the sun gear at points 120 deg apart the idler pinions must mesh with the ring gear at points 120 deg apart, Fig. 4.

For the gears to do this, their design must satisfy three conditions and a fixed method of assembly is necessary to secure correct timing. These conditions are:

1. The sum of the number of teeth in the sun pinion and idler gears must be divisible by 3.

2. The number of teeth in the ring gear less the number of teeth in an idler pinion must be divisible by 3.

3. A tooth on the idler pinion must have a fixed equal angular relation to a tooth on the idler gear of all idlers. This is shown in Fig. 4 where a vertical line from the center of each idler pinion falls between a pair of marked teeth on the idler pinion and on the idler gears.

In assembling, the idler gears must be set so that alignment points are all in the same direction and lines connecting the points to the center of each idler are parallel, as shown by the vertical lines *AG*, *BH* and *CI*, Fig. 4.

Load division among the three idlers of any planetary system depends on the accuracy of all parts. In the simple train of gears, load division is dependent on tooth spacing and concentricity of all gears, tooth thickness of the idler gears, concentricity of bores in housing in which ring gear, spider and pinion are mounted, concentricity, spacing and actual size of bearing bores in spider, and concentricity of all bearings supporting pinion, idlers and spider. In addition to these requirements the compound train must have accurate relationship of idler-pinion teeth to idler-gear teeth, and where helical teeth are used the axial location of all idlers must be accurately held.

The problem of maintaining accuracy of every part of a system in order to secure proper load division is probably the reason why planetary gearing has only recently become widely accepted as a reliable system for speed reducers and gear-motors. Modern machine tools are required to produce parts of the required accuracy consistently. There are still many manufacturers and users of machinery who avoid planetary gearing because of the many ways in which errors affect load division, but manufacturers of planetary gearing know that with proper machine tools and manufacturing methods combined with good lubrication, a load-division efficiency of 90% can be obtained consistently.

Planetary-gear ratios are somewhat puzzling to many industrial and power engineers. Direct ratio of teeth does

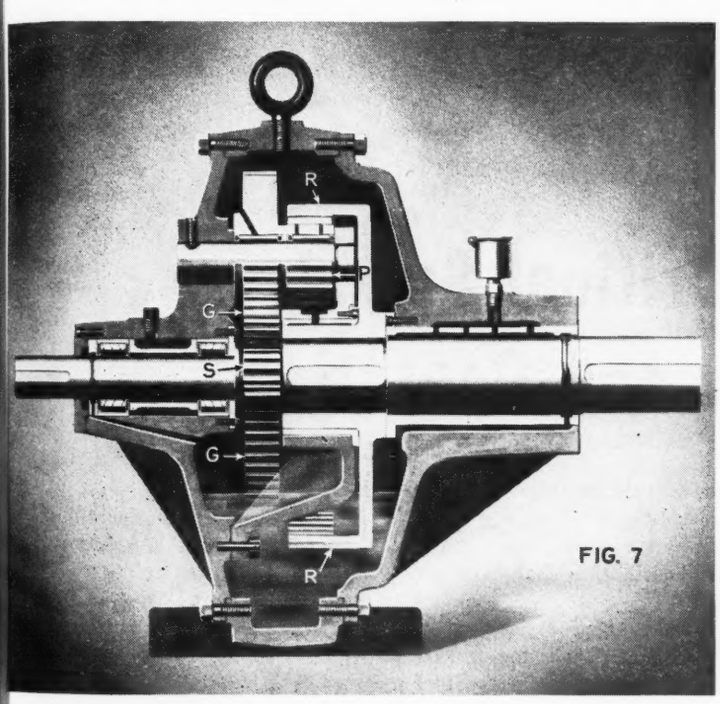


FIG. 7

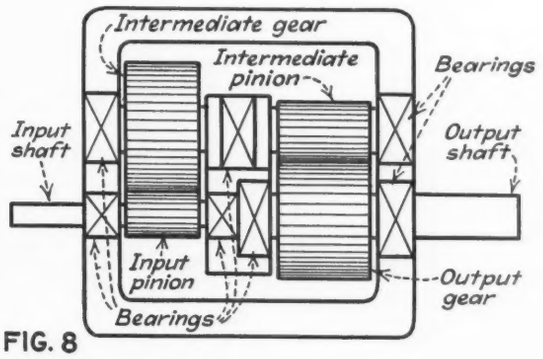


FIG. 8

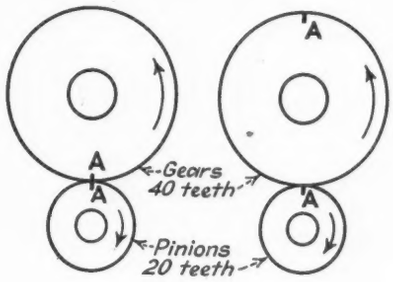


FIG. 9

FIG. 10

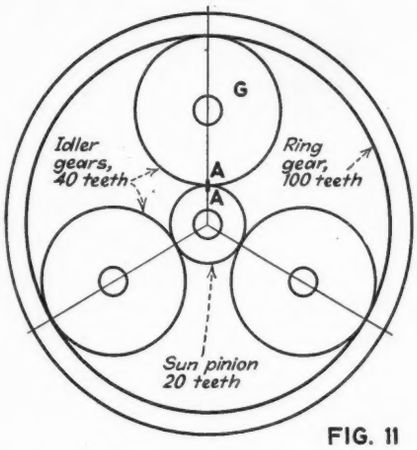


FIG. 11

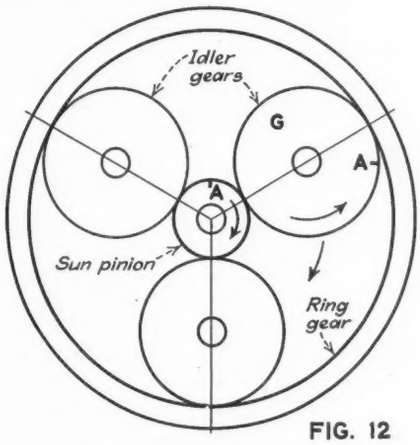


FIG. 12

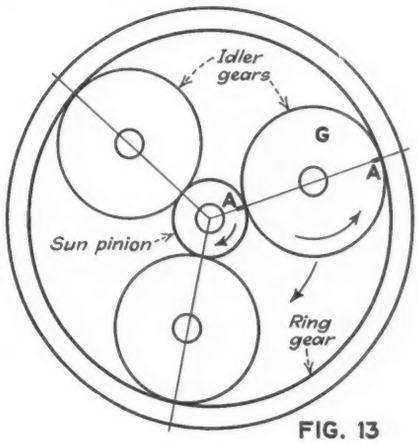


FIG. 13

Figs. 11, 12, 13—Operation of a simple planetary-gear system

not give the speed ratio, since the idlers rotate about their axes and at the same time revolve bodily about the pinion as the spider rotates. To properly analyze the speed ratio, both motions must be considered.

Fig. 9 shows a simple pair of gears in which we will assume that the pinion has 20 teeth and the mating gear 40 teeth. If we rotate the pinion clockwise the gear will be turned counter-clockwise. When the pinion makes one revolution, point *A* on it returns to its original position and the gear will be revolved through an arc of 20 teeth or one-half revolution, Fig. 10. Here the speed ratio is the inverse of the gear-teeth ratio, 1:2, or 2:1. That is, the gear rotates one-half as fast as the pinion.

Now let us see what happens in a planetary-gear system in which the sun pinion has 20 teeth and the idler gears have 40 teeth, as have the simple pinion and gear, Fig. 11. Since the number of teeth in the ring gear is the sum of the teeth in the sun pinion plus twice the idler teeth, the ring gear will have $20 + (2 \times 40) = 100$ teeth. Thus the ratio of the sun-gear to the ring-gear teeth is 20:100, or 1:5.

For simplicity consider only idler gear *G*, Fig. 11. Assume the sun pinion makes one revolution, Fig. 12. The idler gears rotate counter-clockwise as for the simple pinion and gear, but they also move clockwise around the sun pinion within the ring gear. As a result the idler gears have gained on the pinion so that the 20 teeth of the sun gear have not all contacted teeth in the idler gear *G* and it has not revolved 20 teeth and has not meshed 20 teeth with the ring gear.

For the idler gear to mesh 20 teeth with the ring gear the sun gear must make one revolution plus the ratio of sun-pinion to ring-gear teeth, or $1 + (20 \div 100) = 1.2$ revolutions, Fig. 13. Then for the idler gears and the output shaft to make one revolution within the ring gear the sun gear will have to make $1.2 \times 5 = 6$ revolutions. In other words, the speed ratio is one greater than the inverse ratio of the number of teeth in the sun pinion to the number of teeth in the ring gear.

We may therefore say that in a single- planetary-gear system, output speed = input speed ÷ [1 + (ring-gear teeth ÷ sun-gear teeth)]. If we assume a sun-pinion speed of 1800 rpm in Fig. 13, then, output speed = 1800 ÷ [1 + (100 ÷ 20)] = 300 rpm.

Because the idler gear travels around the sun gear in its direction of rotation, the speed of the idlers is not in ratio to the number of teeth in the two gears, but as given by the relation: idler speed = output speed × [1 − (ring-gear teeth ÷ idler-gear teeth)] = 300 × [1 − (100 ÷ 40)] = 300 × 1−2.5) = 300 × −1.5 = −450 rpm. The minus sign indicates that the idler gear rotates in an opposite direction to the sun gear.

Because the idler gears rotate in opposite directions to the spider that carries them around inside the ring gear, the idler bearings actually rotate

(Continued on page 130)

✦ ✦ ✦

Influence of Critical Speed on Shaft Design and Operation

In describing what critical speed is and means, H Engvall, De Laval Steam Turbine Co, explains the conditions that determine whether a turbine should be designed to operate above or below its critical and by how much

▶ REGARDLESS OF THE ACCURACY of a rotor when it is produced, its center of gravity will never coincide exactly with its axis of rotation. When the rotor revolves, the center of gravity accordingly moves about the axis of rotation, producing a centrifugal force that tends to deflect the shaft and which increases with speed. At a certain definite speed, centrifugal force exceeds the elastic restoring force, because of shaft deflection, and the rotor vibrates as if it were seriously unbalanced. This is called the *critical speed*. If the rotor were run at that speed with no restraining forces, shaft deflection would increase progressively until the shaft broke.

In practice the critical speed is reached and passed without danger to the shaft because of frictional forces that suppress vibratory motion. The magnitude of these forces depends on the density of the medium in which the shaft rotates. In a high-density medium such as water, critical speed almost disappears, but becomes increasingly noticeable as the medium's density decreases. After passing through the critical speed, the rotor revolves smoothly about its center of gravity.

The weight of the rotor and the shaft dimensions determine critical speed. This speed remains the same regardless of whether the rotor runs in a horizontal or vertical position and outside forces; tooth pressure on a pinion, for example, do not affect it. Smooth operation of any rotor requires, of course, as nearly perfect balance as is possible.

A machine designed to operate below its critical speed is said to have a *rigid shaft*, while one designed to operate above its critical speed, has a *flexible shaft*. Critical speed of a rigid-shaft machine should be at least 120% of its operating speed, and that of a flexible shaft machine 60 to 70% of its operating speed. Fig. 1 shows the effect of critical speed on operation of a well-balanced rotor with a flexible shaft, where the amplitude of vibration is plotted against percent of normal speed of a constant-speed turbine.

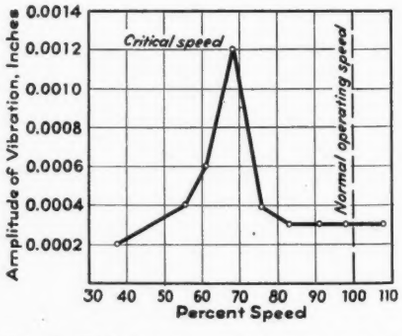


Fig. 1—Relation of operating to critical speed in a constant-speed turbine

Selection of the shaft, rigid or flexible, to be used in a given machine is determined by a number of considerations. The most important of these are whether the machine is to be operated at constant or variable speed, torque to be transmitted, type and size of rotor, and operating speed.

A variable-speed machine usually has a rigid-shaft rotor to avoid operating at or near the critical speed. However, a well-balanced rotor supported in vibration-dampening bearings can run even at critical speed without danger or noticeable vibration. In some cases the torque transmitted through a shaft requires a size that automatically results in a rigid-shaft rotor.

Drum rotors used in reaction turbines, as well as rotors manufactured from one solid forging used in low-pressure turbines, are rigid at operating speeds.

Single-stage and topping turbines are examples of machines in which the torque transmitted requires shaft size that is rigid. Another typical example of rigid-shaft machine is the marine turbine, which must operate continuously at speeds anywhere from zero to maximum. Blast-furnace-blower turbines must operate at variable speeds and have a high power output and a comparatively low maximum speed.

Flexible-Shaft Turbines

High-speed turbines operating at constant speed are typical flexible-shaft machines. In such turbines a rigid shaft would mean extra-heavy, and therefore expensive, turbine wheels, increased overall length and excessively large bearings. It would also mean higher rubbing speed at labyrinth and carbon rings, requiring larger clearances, and the resulting increase in interstage and gland leakage would result in lowered efficiency. The influence on efficiency naturally increases as power decreases.

Fig. 2 shows a blast-furnace-blower turbine. This machine must operate over a wide speed range and is, therefore, designed with a large rigid shaft. It has 12 stages, operates normally at 3000 rpm. and has a shaft 11 in. in diameter that runs in bearings set 6 ft 11 in. between centerlines. The rotor weighs 6000 lb, with a calculated critical speed of 4100 rpm, or 133% of operating speed.

The compressor-drive turbine, Fig. 3, operates from 2775 to 3400 rpm. Although this is not strictly a constant speed, the speed range is such to permit using a flexible shaft. This 16-stage turbine has a shaft 8 in. in diameter, with 7 ft 8½ in. between bearing centerlines. The rotor weighs 6800 lb, and its critical speed is 1900 rpm, or 56% of the maximum and 68.5% of the minimum operating speed.

Although the two turbines look very much alike, a comparison of the rotor data shows how the rotor selected influences the design. The rigid-shaft machine with a lighter rotor and fewer stages has a shorter span between bearings, and operates at a slower speed with a shaft that is 37.5% larger in diameter than that for the flexible-shaft machine.

Dr De Laval was the first to recognize the fundamentals of critical-speed theory and his work made high-speed turbines possible. The operating speeds of the early De Laval single-stage turbines were seven times the critical speeds, ranging as high as 50,000 rpm. The smallest possible shaft diameter was accordingly used, resulting in designs such as Fig. 4, which shows the rotor for the first steam turbine developed.

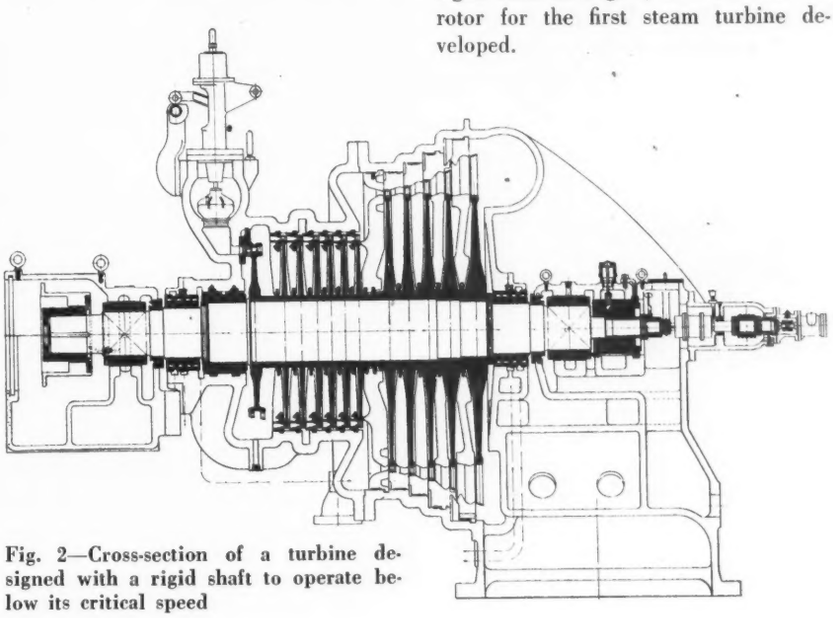


Fig. 2—Cross-section of a turbine designed with a rigid shaft to operate below its critical speed

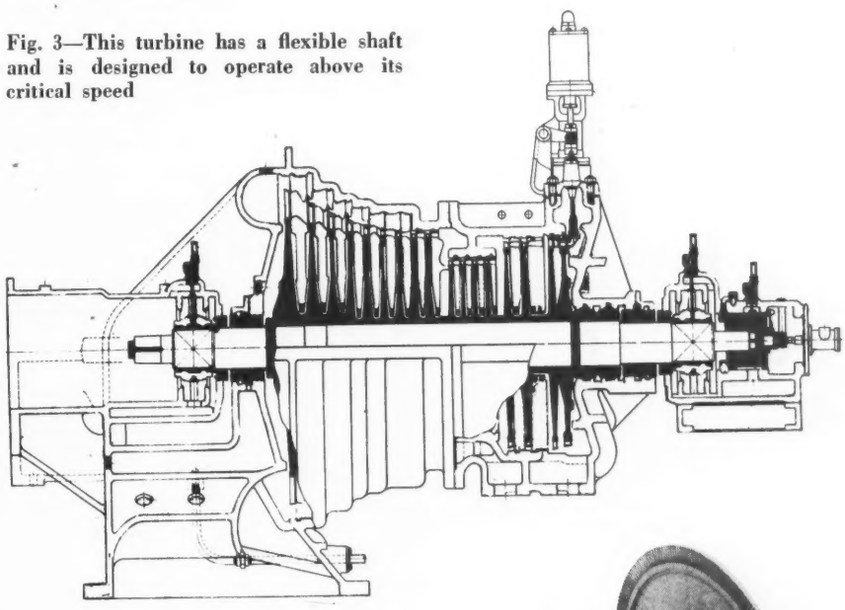


Fig. 3—This turbine has a flexible shaft and is designed to operate above its critical speed

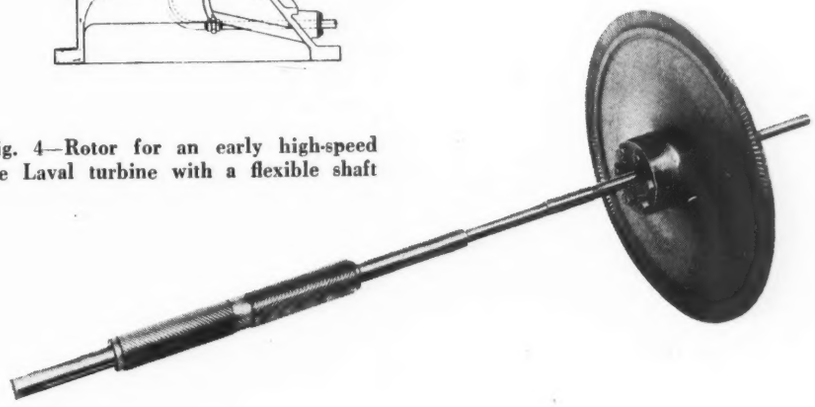
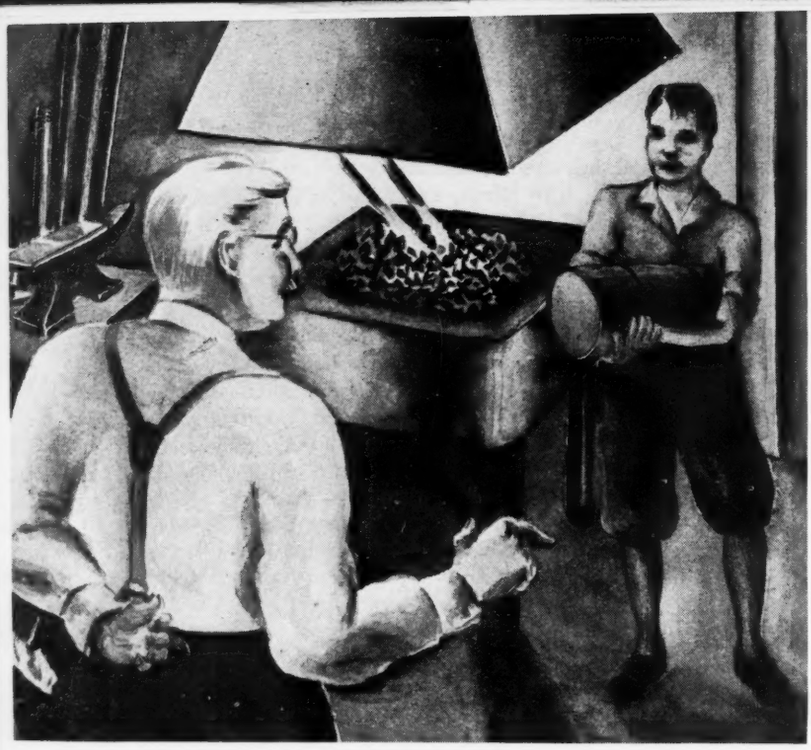


Fig. 4—Rotor for an early high-speed De Laval turbine with a flexible shaft



. . . I noticed the Old Chief looking very curiously at a boy who was staggering through the shop with a 40 lb hunk of scrap iron

THE OLD CHIEF

XVI—"Traditions"

Sixteenth in a series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies beneath the maze of power-plant costs and the wavy lines on paper disks

▶ BACK IN THE DAYS when I was firing boilers for the Old Chief I used to tumble out of bed at 5:20 am in order to be on the job, stripped to the waist, at six o'clock. We had no card to punch, you just called out your number to the time clerk and he moved your brass check from the "out" side of the board to the "in" side. At nine we were allowed twenty minutes, in turns, for breakfast.

Toasted Sandwiches

We usually ate this in the blacksmith's shop. We boiled our can at his forge and on cold days would heat a piece of iron red hot and hold it over our sandwiches with a pair of tongs until we had toasted sandwiches deluxe. Of course, sparks would fly off the iron but we would flick most of them off; suffice to say that no doctor has ever had to prescribe iron for my constitution. Only on rare occasions when hunting up north have I enjoyed breakfasts as I did back in the old blacksmith's shop.

The Devil Himself

At one time we had a shower in the pump house, but we had to leave most of our dry clothes on the other side of the boiler room. This resulted in the flitting back and forth of more or less naked men at every shift change.

One evening, just after six pm, we had visitors in the boiler room while Big Red Hogan, a six-foot-five Irishman, was busy scrubbing himself. Some of the boys pinned something resembling a tail on his honest-to-goodness red flannel combination underwear so that when he legged it across the floor, with his red hair and his tail flying, he looked like the devil himself.

There were a large number of youths employed as helpers, cleaners and messenger boys. Every newcomer had to run the gamut of a series of practical jokes. An unkempt and abashed boy would appear at the office asking for Miss Shumacher, the filing clerk, (a maiden lady of uncertain age). When she asked his business he would produce some pieces of old iron— "to be filed flat across the top and he was to wait for them". The electrician's helper would be sent to the stores for a "double-arc 220-volt short circuit". But the storeman had let it out to the time clerk, who had loaned it to the "Boss" laborer, who had only borrowed it for the man in the gantry crane. A climb up the crane would only send him further out of his way.

"Metal Stretcher"

One day I noticed the Old Chief looking very curiously at a boy who was staggering through the shop with a 40-lb hunk of scrap iron. I recognized it as a broken drive gudgeon that we had thrown on the scrap months before.

When the Old Chief asked the boy what the "big idea" was, the boy explained that it was the "metal stretcher" and that they wanted it to stretch a piece of angle iron, so that the rivets would fit better. He added that he had previously brought them one, but it was a "left-handed" one and they could not use it.

Then followed a word to the storeman about wasting the company's time and the danger of boys hurting themselves seriously carrying heavy stuff like that. On the whole, however, it must be admitted that the grownups derived just as much amusement from the practical jokes as the youths did. They were looked upon as a traditional form of hazing and perhaps was just as sane or insane a practice as the present-day hazing indulged in by college boys old enough to know better.

Christmas Turkeys

One of the happy traditions of the old plant that unfortunately died a natural death during the lean years was the annual Christmas draw for twelve turkeys.

Everyone kicked in with 50 cents, the firm donated the turkeys and there was a prize for everyone. It was always good for a half-dollar's worth of laughs. Invariably the painter, who was a temperance advocate and a lay preacher, would draw the bottle of whisky, and the blacksmith, whose skill as a tradesman was only equaled by his reputation as a drinking man, would draw a small box of biscuits. Miss Shumacher would win the biggest turkey and Red Hogan with nine kids would win a box of firecrackers. However, many unselfish exchanges would take place and I look back on the drawing as one of the pleasant traditions of the old days I hated to see fall by the wayside.

MORE POWER FROM EXISTING EQUIPMENT—2

Practical suggestions for increasing capacity quickly and with minimum use of strategic materials

STEP-UP STOKERS FOR WAR LOADS

By L N ROWLEY, *Associate Editor*

Here are practical ways to increase output of grate-fired boilers without extended shutdowns or heavy use of strategic materials

▶ Basically, there are three ways to increase stoker capacity: (1) by increasing grate area, (2) by removing limitations on the burning rate so that each square foot of grate surface can be put to most effective use, and, (3) by installing some kind of auxiliary firing. A single case may involve two or more of these principles; for the sake of clarity this article will first take up suggestions for changes in the coal-handling system, then changes in the stoker itself, changes to the furnace, and methods of auxiliary firing. Finally, because coal selection, maintenance, and methods of operation all affect stoker output, these matters will be covered briefly.

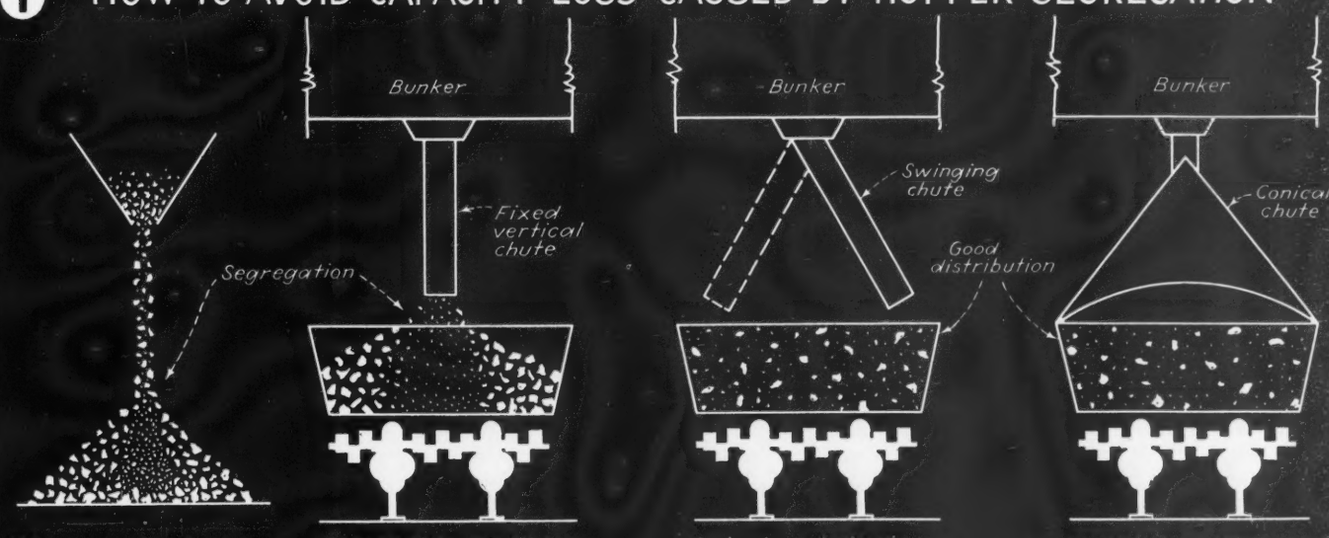
To increase heat liberated by the stoker requires a matching increase in the heat-absorbing capacity of the boiler. In many cases, this extra heat-absorbing ability exists and can be called on at no greater cost than the small loss of efficiency that usually goes with high-rating operation. In some cases, changes in the boiler will be necessary; suggestions along these lines will be made later in this series. Likewise, increase in stoker output will nearly always involve need for more draft-system capacity. For suggested ways to increase draft-system performance, see POWER, February, 1942, p. 57.

Coal Handling

Because most coal-handling systems are designed for part-time operation, the higher capacities required by any increase in stoker output can be absorbed by running the coal-handling equipment for longer periods. However, even if the coal-handling system can supply the necessary amounts of fuel, it may still limit maximum stoker capacity by causing segregation troubles.

Segregation means uneven distribution of different-size coal pieces. A desirable stoker coal contains a range of sizes from coarse to fine, the exact size limits and the percentage of each size that are most desirable varying with the particular installation. To insure best burning conditions the pieces

1 HOW TO AVOID CAPACITY LOSS CAUSED BY HOPPER SEGREGATION



When coal falls to a conical pile, coarse pieces roll and slide to outer edge and bottom; fines tend to remain under line of fall

Segregation in stoker hopper (fine in center, coarse at sides) causes uneven fire, loss of capacity

Swinging chute gives even distribution; mechanical swinging can be arranged in several ways

Conical non-segregating chute gives even distribution; keep chute filled at all times for proper operation

of different size must be uniformly distributed across the fuel bed. Anything in the handling arrangements that causes fines to concentrate in one part of the bed and coarse pieces in other parts will make for poor fuel-bed conditions and will reduce burning rate and stoker capacity.

How Segregation Occurs

When coal particles of different size fall from a single point on a conical pile, segregation occurs. The coarse pieces tend to roll and slide down the pile to the bottom and outer edges while the fines tend to stay in the line of fall, winding up in the center of the pile. This common kind of segregation occurs when coal is dumped into a bunker from a single point, and in a stoker hopper when a fixed chute of the common garden variety is used.

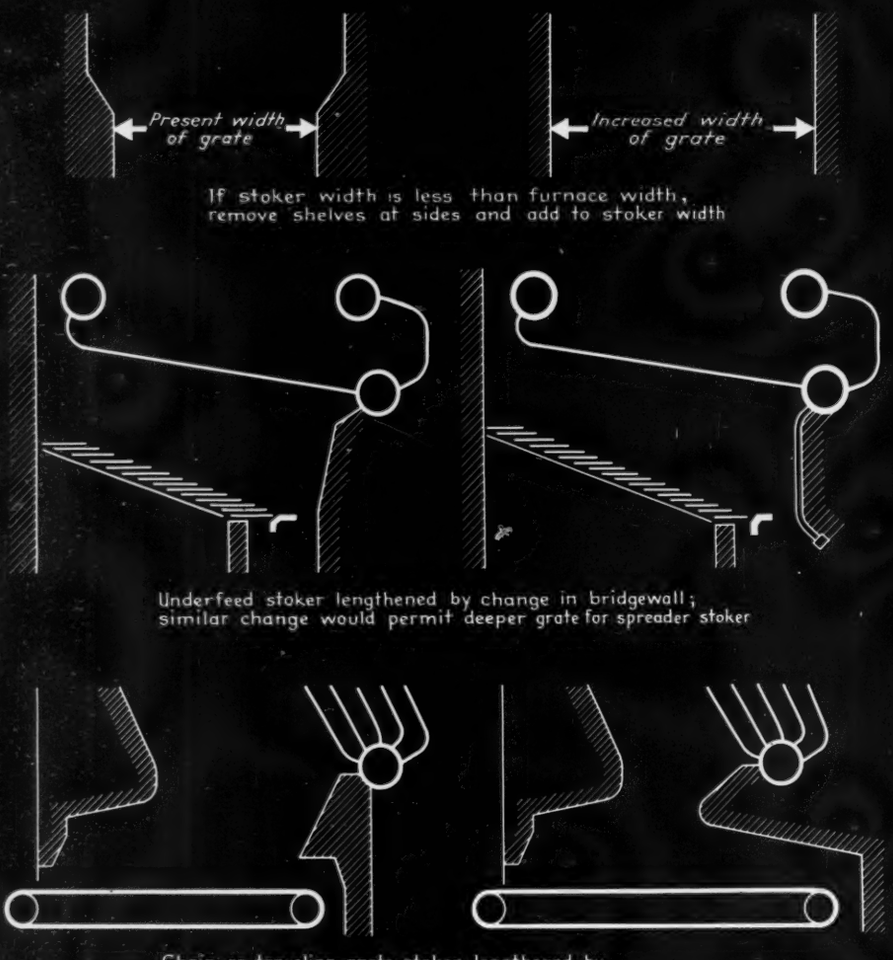
Segregation in the bunker can be reduced materially by unloading at several points instead of one, or by mixing the coal as it is unloaded. If these prove impractical, the effects of segregation can be partially overcome by discharging from the bunker at more than one point. For example, in an ordinary suspended bunker loaded at a single point or at several points some distance apart, the fines will concentrate under the loading points and the coarse pieces will concentrate at the sides of the bunker and between the loading points. Some remixing can be effected by discharging from the bunker through a series of chutes running from various points along the bunker to a common chute leading to the stoker hopper. If traveling larries are installed, the same results can be obtained by loading the larry from several points along the bunker rather than from a single point.

Stoker-hopper segregation is possibly more common and more serious although anything done to correct segregation at this point will have little value if distribution in the bunker is bad. The common cures for hopper segregation, Fig. 1, are swinging spouts and specially designed conical chutes. The swinging spout can be moved back and forth across the hopper manually, or a simple mechanical arrangement can be installed to move it automatically. Traveling larries are equivalent to swing spouts if the operator is careful to move the larry back and forth while filling the hopper. Conical chutes should be kept filled for satisfactory operation.

Operators of forced-draft chain-grate stokers can usually reduce segregation troubles at the source by selecting from the more closely sized and finer coals now carefully prepared by many producers.

Troubles caused by segregation are more common and serious than most operators realize and this point should not be overlooked if more stoker output is needed. Depending on the severity of the condition, elimination of segregation will permit increasing burning rate from 5 to 15%, possibly more in some extreme cases.

② THREE WAYS TO INCREASE GRATE AREA


Present width of grate
Increased width of grate
If stoker width is less than furnace width, remove shelves at sides and add to stoker width
Underfeed stoker lengthened by change in bridgewall; similar change would permit deeper grate for spreader stoker
Chain-or traveling-grate stoker lengthened by substitution of rear arch for bridgewall

These are typical of changes that can be made to increase grate area. Only by examination of your stoker and furnace and consultation with the maker of your stoker can you tell whether these or other methods will fit your case

Stoker Changes

▶ The simplest possible change to increase stoker capacity is, of course, an increase in speed. However, this only applies to units installed to operate at conservative burning rates. Usually a change in gearing or in drive equipment is required. The capacity gains to be made by this method depend on how far below the maximum burning rate for the particular conditions the unit was operating. If changes in the furnace are made, as described later, the maximum burning rate can be boosted and the capacity further increased.

Increases in grate surface require extensive alterations but in many cases are entirely practical. Fig. 2 shows typical ways the space needed for more grate can be gained. Many older stokers were installed narrower than the furnace, with shelves built at the sides. Removal of these shelves will sometimes permit adding as much as 20% to the width and thus to the grate area and capacity. Changing shape or location of the bridgewall permits adding to stoker length some cases. Chain- or traveling-grate stokers installed in furnaces of the older type with long front arch and practically no rear arch can be lengthened by replacing the bridgewall with a rear arch, as shown in Fig. 2. In many cases this will improve

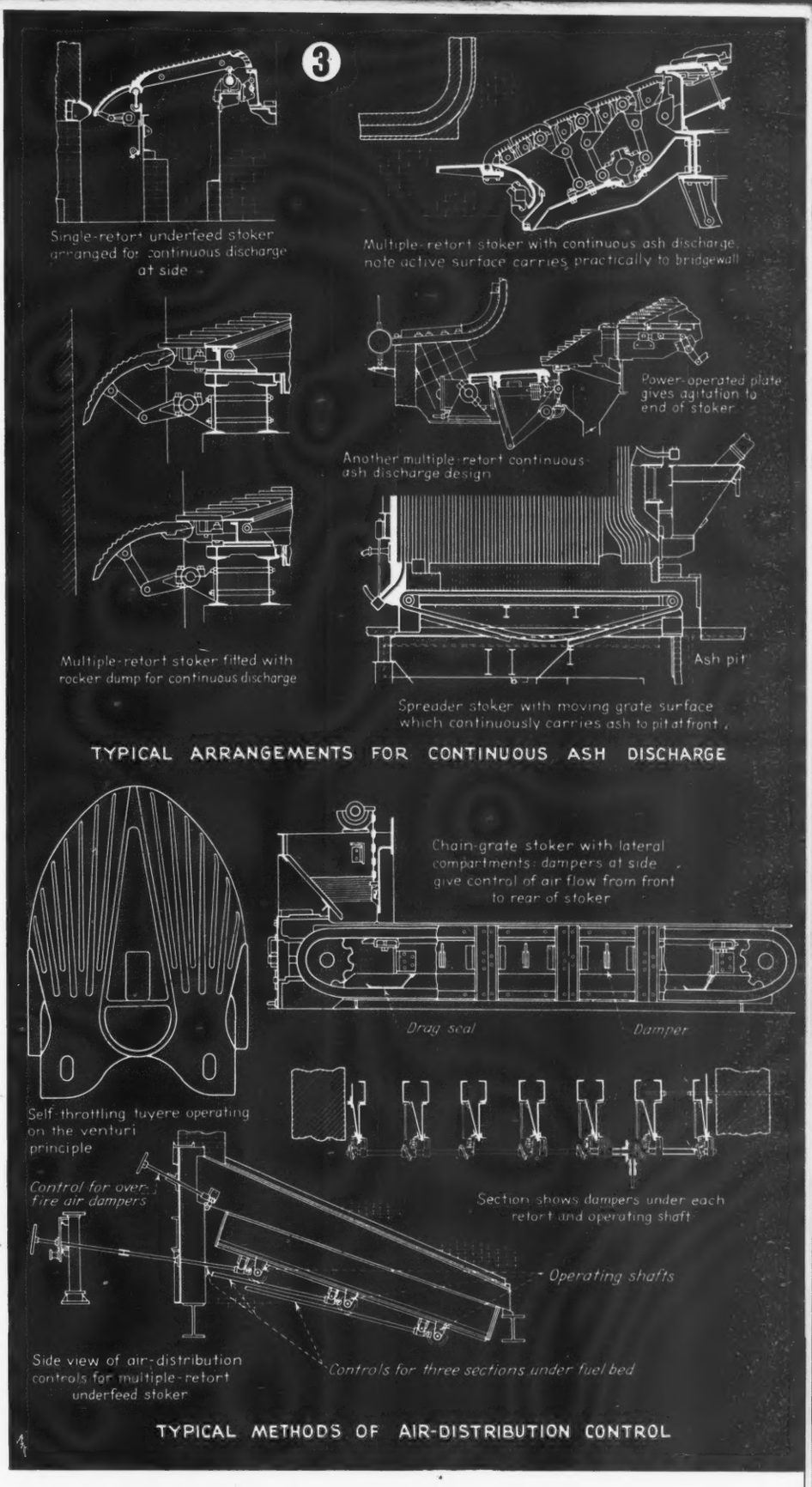
combustion conditions also, by directing lean gas from the rear toward the front for better mixing with rich gas. Several cases have been reported in which length and capacity of multiple-retort underfeeds have been increased by inclining the bridgewall to form a short, water-cooled rear arch.

Changing from intermittent to continuous ash discharge increases capacity up to 25% on multiple-retort underfeed stokers. It was formerly necessary to install clinker grinders to secure the advantages of continuous ash discharge but recently developed systems bring most of the advantages of clinker grinders to the smaller installation along with the low first cost, simplicity, and compactness of the dump plate. Fig. 3 shows three methods of continuous ash discharge for underfeed multiple-retort stokers and also arrangements for single-retort underfeeds and spreaders. Chain- and traveling-gate stokers and most overfeed units are inherently of the continuous-ash-discharge type.

Continuous Ash Discharge

Continuous discharge of ash virtually eliminates the loss of output and the disturbance of combustion conditions that occur when ash is dumped periodically. When the continuous-ash-discharge arrangement replaces a dump plate, as on multiple-retort underfeeds, the active grate area is increased; the illustration of the discharge end of a multiple-retort stoker shows this clearly. Many stoker manufacturers are in a position to replace older ash-discharge equipment with continuous systems; this change can be made, under proper conditions, in less than two weeks' working time in the field.

A stoker really burns two fuels—coal and air. Best results depend on combining these two in the proper relationship at each stage of the combustion process. Control of air from windbox entrance to fuel bed, now considered essential, may be found inadequate on many older stokers of all types. On multiple-retort underfeeds, baffling or dampers should direct most of the air to the front of the stoker and proportionately less to the overfeed and ash-discharge sections. Wide units may need control across the width as well. Chain- and traveling-grate stokers usually require most air just ahead of the middle and proportionately less at front and rear. Modern chain- and traveling-grate units are compartmented to control air distribution; many older natural-draft units can be converted to forced-draft operation and equipped with compartments and dampers. Any stoker not now equipped for control of air distribution should be studied from this angle; call on the maker for advice regarding increased capacity and physical details involved.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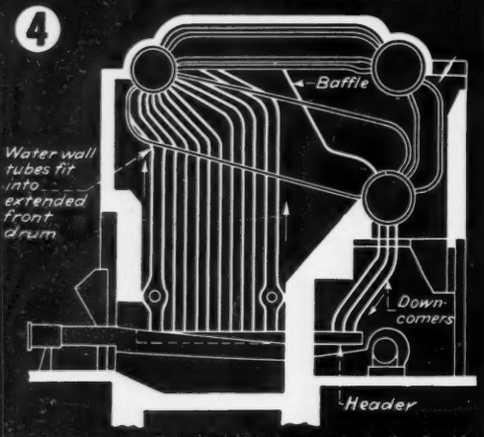
Single-retort underfeed stoker arranged for continuous discharge at side
Multiple-retort stoker with continuous ash discharge; note active surface carries practically to bridgewall
Power-operated plate gives agitation to end of stoker
Another multiple-retort continuous ash discharge design
Multiple-retort stoker fitted with rocker dump for continuous discharge
Ash pit
Spreader stoker with moving grate surface which continuously carries ash to pit at front
TYPICAL ARRANGEMENTS FOR CONTINUOUS ASH DISCHARGE
Chain-grate stoker with lateral compartments; dampers at side give control of air flow from front to rear of stoker
Drag seal
Damper
Self-throttling tuyere operating on the venturi principle
Control for overfire air dampers
Section shows dampers under each retort and operating shaft
Operating shafts
Side view of air-distribution controls for multiple-retort underfeed stoker
Controls for three sections under fuel bed
TYPICAL METHODS OF AIR-DISTRIBUTION CONTROL

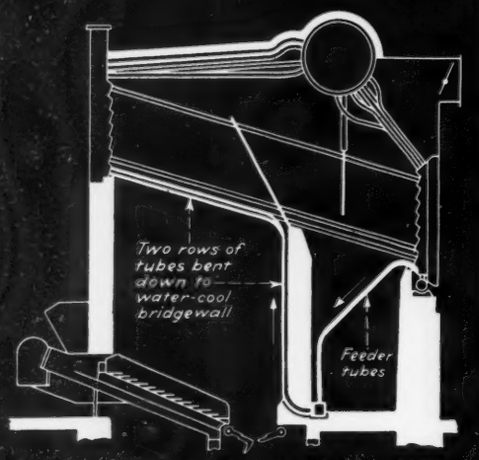
Air-distribution control doesn't stop under the grate. Performance of many older stokers can be stepped up by changes in the grate surface. The modern tuyere for a multiple-retort underfeed shown in Fig. 3 gives more uniform air flow, improved cooling of the grate structure and more stable operation at high burning rates. On some chain grates, use of narrow instead of standard links will distribute air more uniformly and improve grate cooling.

Furnace Improvements

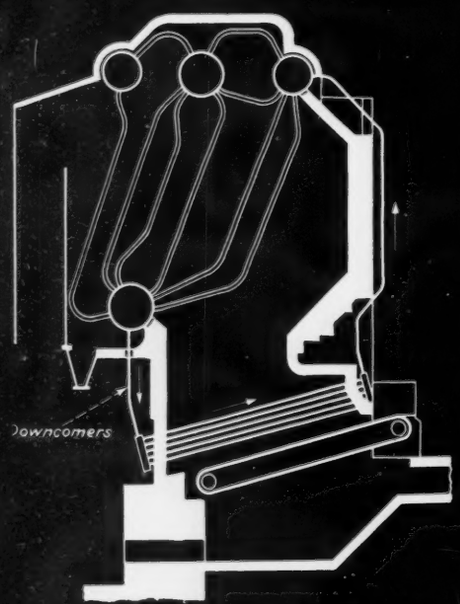
THREE WAYS TO REDUCE FURNACE TEMPERATURE BY ADDING WATER COOLING



Side waterwalls applied to bent-tube boiler fired by twin-retort underfeed stoker



Water-cooled bridgewall applied to straight-tube boiler fired by multiple-retort underfeed stoker



Water-cooling applied at sides of compensating-feed stoker in Stirling boiler

These are only a few examples of the numerous ways in which a small amount of water cooling may be applied to lower furnace temperature. Only by examination of your furnace and consultation with the maker of your stoker can the best solution for your case be found

▶ In many plants, furnace changes will remove limitations on the stoker burning rate. Where stoker capacity has been increased by adding surface, increasing speed, or other means described in the preceding pages, changes to the furnace may be necessary to obtain full advantage from the stoker improvements. Most furnace changes can be made without extended shutdown and most of the materials involved (brick, cement, and tiles) can be obtained readily.

Excessive furnace temperature limits burning rate by causing clinkering, slagging, and high maintenance of walls and grate structures. For these symptoms, the indicated cure is watercooling. Addition of waterwalls to an existing furnace is often considered a major operation involving long outage and high cost. In most cases a surprisingly small amount of waterwall surface will effect the desired results and the field changes can be made in a week or two. Capacity increase depends on how bad the existing condition is, but gains up to and over 30% are not uncommon.

The sketch, top left, shows waterwalls applied to a twin-retort-underfeed-stoker-fired low-head boiler. The tubes run from the extended front drum to a square header at the stoker grate line. This arrangement, an actual installation, increased capacity, and virtually eliminated furnace maintenance. The sketch below, another actual case, illustrates an easily made change. New tubes, which were passed over the furnace and then bent down to form a water-cooled bridgewall and clinker chill, replaced the lower two rows of boiler tubes. Stoker retorts were deepened, a different tuyere design was substituted, and sidewall air blocks were added. These changes increased capacity from a hard-to-maintain 30,000 lb per hr to a sure 50,000 lb per hr and reduced furnace maintenance.

The bottom sketch at the left shows a waterwall arrangement that can be adapted to many different furnace and stoker layouts. As illustrated, the waterwall consists of straight tubes between headers, inclined to parallel the grate line. Circulating tubes connect to the drums as shown. With tubes more nearly horizontal this scheme would fit many chain- and traveling-gate units, spreaders and single-retort underfeeds. On multiple-retort underfeeds, the headers are frequently set vertically and the tubes bent to follow the stoker contour. The rear-arch furnace in Fig. 7 shows how straight tubes between short headers also can be arranged vertically.

There are many other ways to add water-cooling surface and each furnace must be studied to find the arrangement that will require the least tube material and fabrication. Excessive water cooling may impair ignition; this can be remedied, if not caught in the design stage, by covering part of the surface with refractory. A further advantage of waterwalls is that they automatically add to the heat-absorbing capacity of the boiler, to match the increase in heat liberation. However, it pays to be sure boiler circulation and steam-releasing capacity of drums are adequate.

Baffle changes increase capacity in two ways: by reducing furnace temperature, and, (2) by increasing gas passages so that larger volumes can be handled without excessive draft loss. To reduce furnace temperature, baffling can be modified to expose more tube surface, Fig. 5. In general, baffle changes should be made only on the advice of stoker and boiler manufacturers or of organizations specializing in baffle design and construction.

Arch Design

Burning rate on many stokers is limited by poor mixing of gas above the fuel bed, with consequent cinder loss and smoking. This difficulty may be a serious limitation where strict smoke ordinances are enforced. On chain- and traveling-grate stokers, skillful arch arrangements, plus overfire air, in many cases will produce good mixing; overfire air will prove valuable on virtually any stoker.

Many older chain- and traveling-grate stokers are set in furnaces with a long front arch and a small rear arch or none at all, Fig. 6. The long front arch was thought to be necessary to provide reflected radiant heat to insure ignition. Experience has shown that front arches can be reduced drastically in size and in some cases eliminated, increasing furnace volume and opening up the gas-passage area. A major weakness of the old furnace designs was the lack of mixing between the rich gas evolved at the front end of the stoker and the lean gas coming off the rear end, where the combustion process is in its final stages.

Many experienced combustion engineers advocate substantial reduction of the front arch and installation of a long rear arch to direct gas toward the front from the rapidly burning portion of the fuel bed at the rear. Particles of ignited fuel are carried in the gas stream and dropped on the fuel bed at the front.

HOW BAFFLE CHANGE MIGHT IMPROVE FURNACE CONDITIONS
Increased gas passage
More tube surface exposed
5
Before making any changes consult maker of your firing equipment or organization specializing in baffle design.

Ignition is always well established and high rates of combustion can be maintained. With proper furnace design there is thorough mixing of gas between the front wall and the nose of the arch, thus avoiding stratification. High rates of combustion can be carried without undue loss of solid carbon in the gas stream or in the ashpit. Rear arches are particularly effective for fuels such as lignite, anthracite, coke breeze, or extremely low-ash coals. Fig. 6 shows a rear arch adapted to a low-set bent-tube boiler, with the aid of cross baffling. Rear arches have been applied to multiple-retort underfeed stokers for better mixing of furnace gas and to improve operation with coals having a tendency to "drift."

Recent experience shows that, in many cases, both front and rear arches can be virtually eliminated, giving an open furnace. The right-hand unit in Fig. 6 was converted to this design from the conventional front-arch furnace of earlier days. The use of high-velocity overfire air through the front arch makes it possible to maintain ignition with a minimum of arch. The result is an open furnace with more effective volume, lower gas velocity and less carryover. Boiler-tube and furnace slagging are further minimized by more extensive application of water cooling, which is permissible because the arch design and overfire air insure proper ignition.

The open-furnace unit shown in Fig. 6 fires "quick-burning" Ohio coal. Operation with the front arch in place (shown dotted) produced extreme temperatures and slagging under the flat arch, and excessive chain temperatures. This required faster chain speed, a thin fuel bed, and blasting of the first and second compartments. After the arch had been shortened to approximate a 60-deg incline, furnace temperatures were visibly lower and chain temperature dropped 200 F at the front end of the stoker. Reduced temperature at the stoker front permitted operation with slower chain speed and thicker fuel bed, blasting the second compartment. Over-all results were improved high-rating operation and increased capacity.

Which of these two modern furnace designs, the rear-arch or the open-furnace, will give the best results in any case depends on the fuel burned and the characteristics of the individual unit. Before any changes of this type are made, the stoker manufacturer should be consulted.

Overfire Air

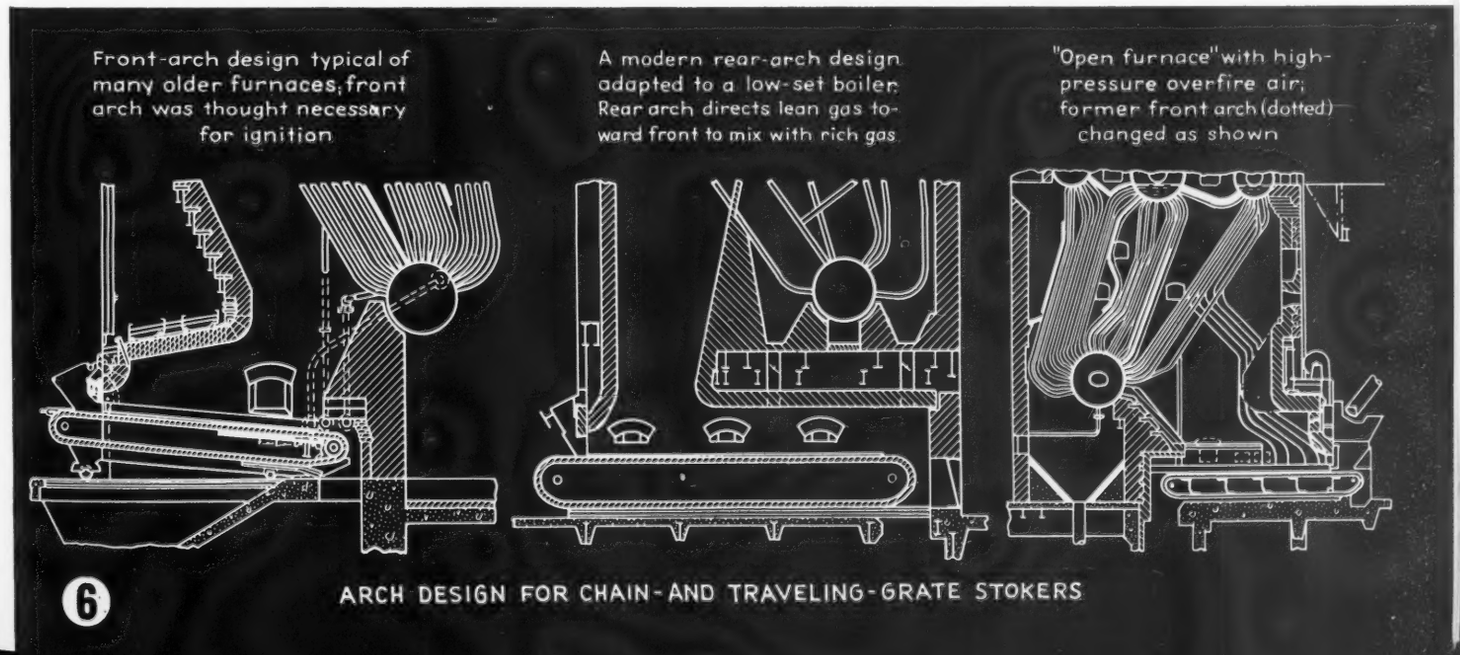
Overfire air is essential to the open furnace discussed above and recent experience shows that, if properly applied, it will improve conditions over most stokers. However, overfire air as used today differs radically in purpose and method of application from overfire air as used in some older installations. The gas evolved from the different parts of any fuel bed varies in quality, some being rich and some being lean. Complete combustion requires that this gas be mixed thoroughly before it strikes the relatively cold tube surfaces. At high ratings, failure to mix means smoke and cinder discharge, which effectively limits capacity in many cases.

To break up the natural stratification of the gas, turbulence is essential. Recent experience shows that such turbulence can be produced with great effectiveness by high-velocity overfire air. Because turbulence is the essential factor rather than air quantity, a steam jet of sufficient velocity will also do the trick. To get turbulence, whether by air jet or steam, requires penetration—the jet must carry well into the furnace to be effective. Most recent applications of overfire air have used pressures ranging from 10 to 30 in. H_2O, velocities from 12,000 to 30,000 fpm, and air quantities from 10 to 20% of total air. The higher the velocity and pressure, the less air quantity required.

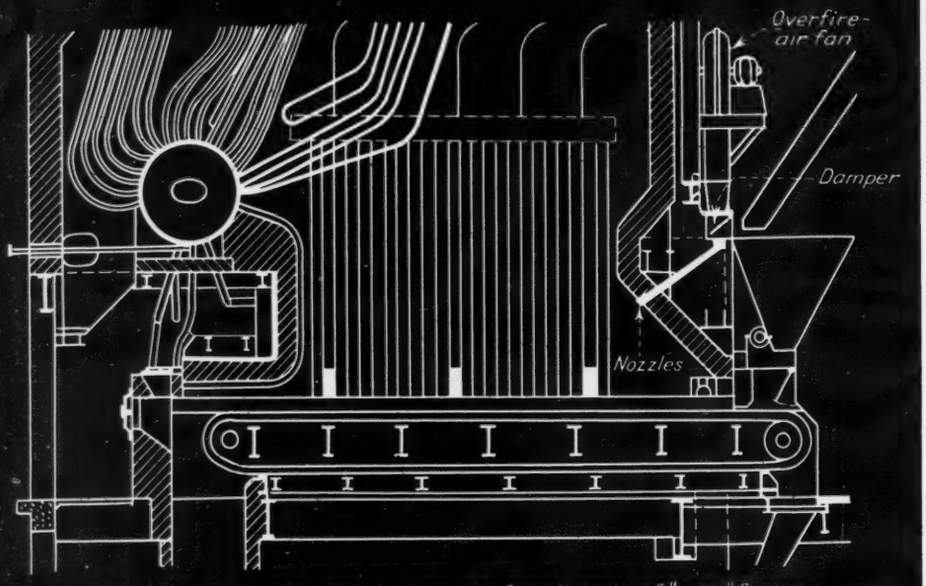
Overfire-Air Systems

Need for high pressure makes it necessary to install a separate overfire-air fan or a booster fan drawing air from the forced-draft duct. Preheated air may prove desirable if it is available. The high pressure means that a substantial amount of power goes to drive the fan, but first cost of fan and motor and operating cost are actually small when compared with the benefits obtained. In most cases, nozzles are made from pipe, but in one plant good results were obtained by cutting nozzles into some of the Bailey blocks in the waterwall tubes. One manufacturer of suspended walls can supply tile nozzles designed to fit into standard tile assemblies.

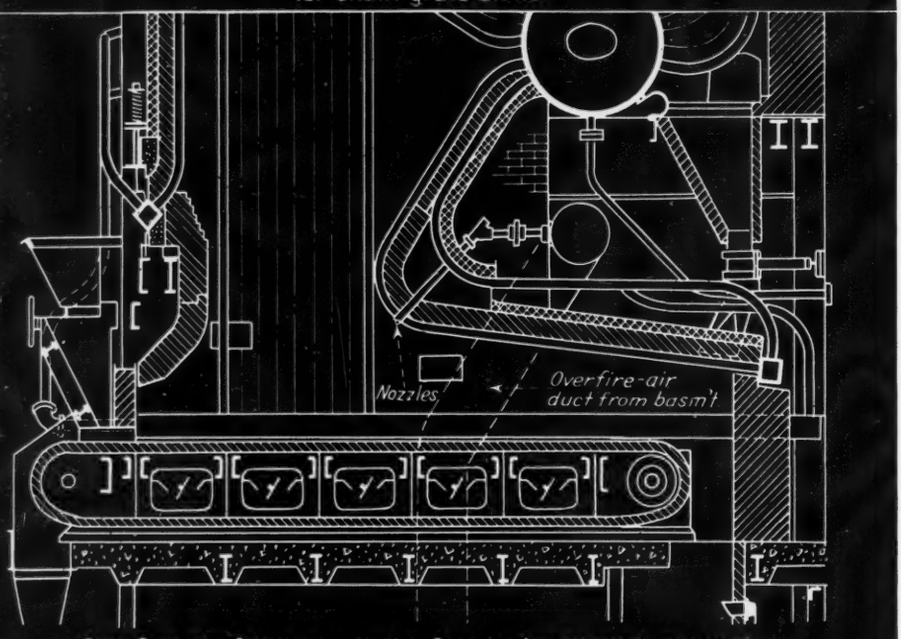
Fig. 7 illustrates several typical applications of overfire air. The unit at the top, of the open-furnace design, has the overfire air fan mounted above the stoker hopper, on the front wall, with the nozzles in the front arch. With this


Front-arch design typical of many older furnaces; front arch was thought necessary for ignition
A modern rear-arch design adapted to a low-set boiler. Rear arch directs lean gas toward front to mix with rich gas
"Open furnace" with high-pressure overfire air; former front arch (dotted) changed as shown
6
ARCH DESIGN FOR CHAIN-AND TRAVELING-GRATE STOKERS

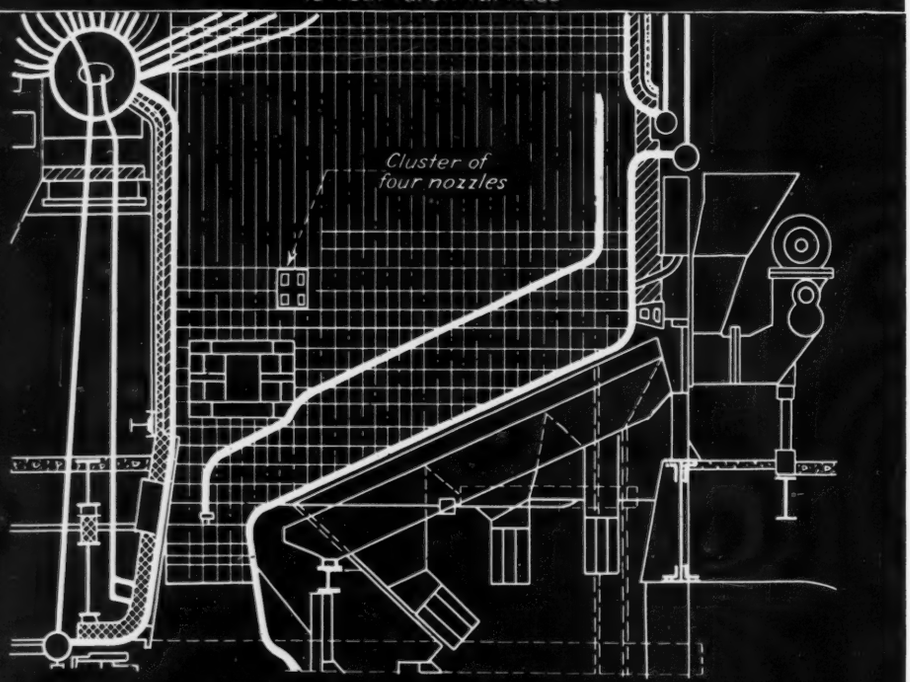
7 TYPICAL OVERFIRE AIR APPLICATIONS



High-velocity air injected through front arch of "open" furnace for chain-grate stoker



Overfire air from separate fan in basement, applied to rear-arch furnace



Overfire air for this multiple-retort underfeed is supplied from clusters of four nozzles in each wall, with jets tangent to a 6-ft circle

type of furnace, such a location insures good ignition. Burning high-volatile low-heat-value Indiana coal, this 55,000-lb-per-hr unit has operated satisfactorily at the designed maximum burning rate of 43 lb per sq ft and a heat release of 30,200 Btu per cu ft per hr. Water-cooled side and bridge walls are provided. The center sketch shows application of overfire air to a rear-arch furnace, with the high-pressure fan in the basement near the forced-draft fan.

Tangential Arrangement

The water-cooled underfeed stoker at the bottom has been fitted with an unusual overfire air arrangement. On each wall, a cluster of four nozzles has been made from Bailey blocks by cutting a rectangular orifice in the block. These clusters are so spaced that the jets are tangent to a 6-ft circle in the furnace, similar to the arrangement used in tangentially fired pulverized-coal furnaces. The front-wall cluster is about 18 in. above the ram box and the other clusters are at the same level. Air pressure of 14 in. H_2O produces a velocity of 15-16,000 fpm at the nozzles. Air supplied runs about 20% of total.

On this 180,000-lb.-per-hr unit, a 24,000-cfm over-fire-air fan takes air from the preheater outlet at about 350 F. A. damper on each nozzle permits individual control and a magnetic coupling was installed between fan and motor to give additional control for experimental purposes. When overfire air is applied to a similar unit in this plant, a constant-speed drive will be used, air pressure will be stepped up to 30 in. and air quantity will be cut to 10%. The jets will be directed tangent to a series of circles instead of one, to give better coverage.

Overfire-Air Results

In operation, velocity is held constant and overfire air is used at all loads. Although overfire air offers greatest advantages at high ratings, experience in this case shows that use at low loads permits carrying higher CO_2 without excessive combustible in flue gas. Overfire air makes it possible to carry higher burning rates for longer periods with less slag and flyash. Use of preheated air for overfire supply increases furnace temperature to some extent.

In most cases, it proves satisfactory to supply overfire air for underfeed stoker units at the rear. Most installations use cold air or air warmed slightly by passage through furnace walls. Preheated air offers advantages in some cases; the amount of preheat permissible depends on the amount of overfire air and the furnace design.

Auxiliary Firing

▶ If the stoker has been boosted to its maximum output or if its age and condition do not warrant expenditure on it, capacity can be increased by some form of auxiliary firing. In most cases, oil or gas burners can be installed to fire over the grate, increasing the output directly. In some cases, particularly where oil burners are applied, the turbulence introduced by the burner will give a slight improvement in combustion conditions over the stoker, acting somewhat in the fashion of overfire air.

Burners must be installed to allow for adequate flame travel (10 ft, minimum) before the relatively cold tube surfaces are reached and to avoid any direct impingement. In most cases, mounting at the rear of the boiler meets these requirements best. Air required for combustion of the auxiliary fuel must be supplied at or near the burners for satisfactory results. If the existing forced-draft system will handle it, air can be taken from the existing duct but a separate fan may represent the best solution in some cases. Provision must be made to handle the added gas volume (see POWER, February, pg 57).

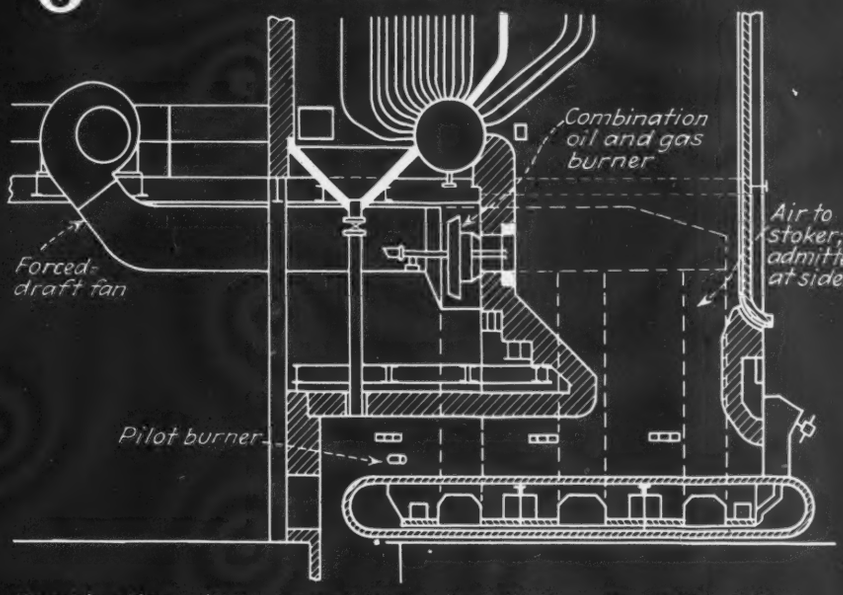
If the unit is to be operated at any time on auxiliary fuel alone, steps must be taken to insure protection for the grate surface. A thick layer of ash will do the trick, but it *must* be there when needed. For long periods of auxiliary firing, the grate should be bricked over or otherwise covered with refractory. Experience with water-cooled stokers shows grate protection is not necessary.

Typical Installations

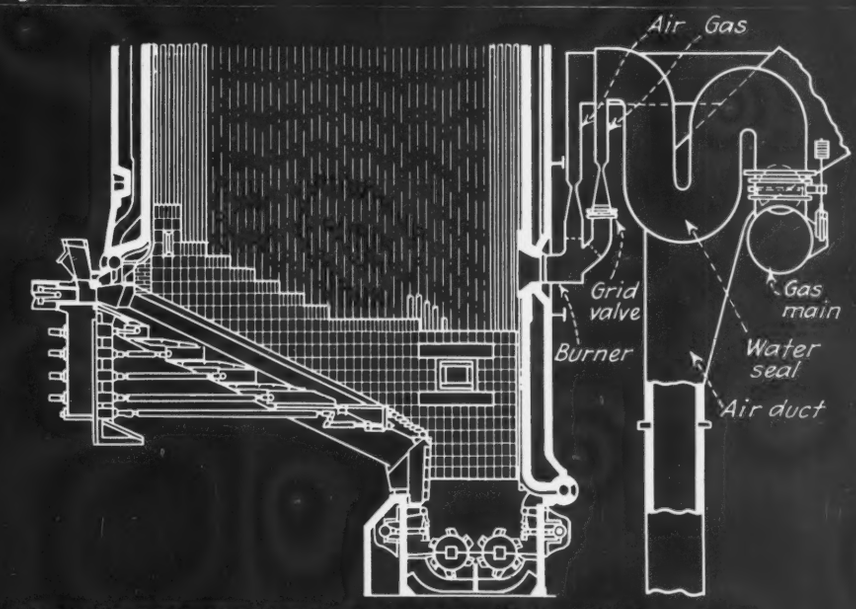
The two upper sketches in Fig. 8 show actual installations of auxiliary firing. The unit at the top illustrates firing of oil and gas, in a combination burner, over a chain-grate stoker in an industrial plant. Burner location at the rear meets the flame-travel limitations. The middle sketch shows the arrangement used for firing blast-furnace gas over a large multiple-retort stoker.

The lower illustration, while not strictly a case of auxiliary firing, represents an ingenious method of increasing capacity. The furnace for an existing chain-grate installation was enlarged by removing the front arch, as shown, and a pneumatic spreader unit was installed. The spreader feeds all coal; fines burn in suspension and larger pieces burn on the grate, which discharges the ash. With a bigger furnace and a feeder of ample capacity, it was possible to increase the capacity of this boiler by 50%.

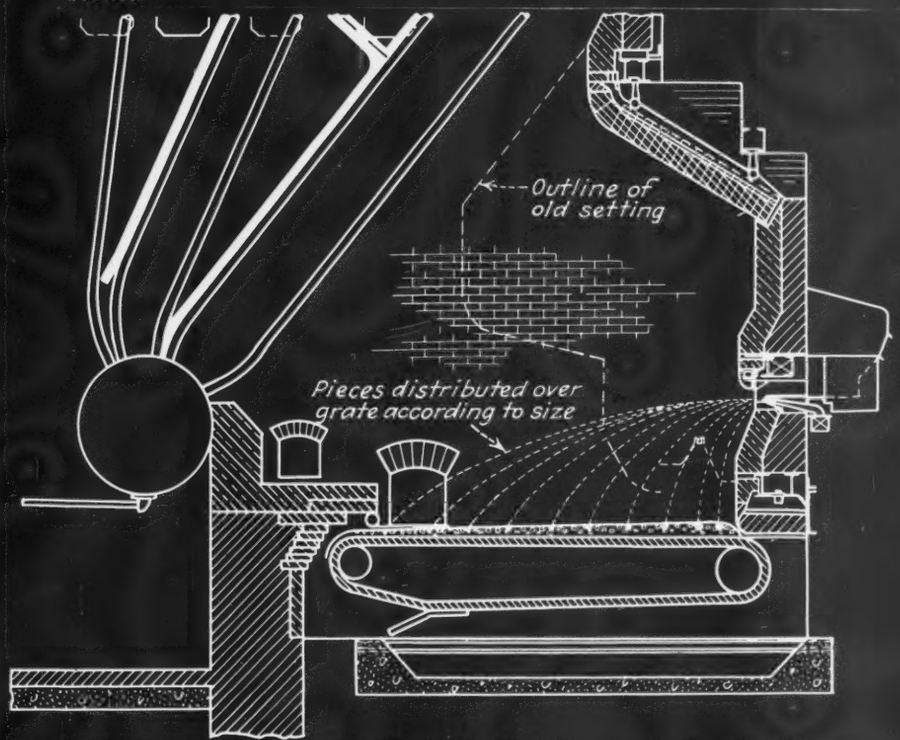
8 TYPICAL AUXILIARY-FIRING METHODS



Combination oil and gas burner installed in rear wall of chain-grate-fired unit



Blast-furnace gas fired over large multiple-retort underfeed stoker



Spreader stoker installed over chain-grate: all coal fed by spreader; fines burn in suspension, heavier pieces burn on grate, which discharges ash

Operation and Maintenance

▶ RESULTS FROM fuel-burning equipment of any kind depend as much on the men who operate and control it as on the equipment itself. Peak performance and maximum reliability call for the utmost in intelligent operation and thorough maintenance.

Perhaps the most important single item in stoker operation is control of excess air. Air supplied must be adequate for practically complete and smokeless combustion; this means an "excess" over the theoretical. Too much excess air reduces efficiency. Too little excess air means a hotter fuel bed and may lead to: (1) clinkering, (2) overheating of furnace brickwork and slagging of boiler tubes, and (3) overheating of stoker parts exposed to fuel-bed heat and dependent on the air supply for cooling.

Indication of the amount of air being supplied usually comes from a steam-flow air-flow or a CO_2 meter. The careful operator will watch for conditions that might cause the readings from these instruments to be misleading. A common source of trouble is air leaking into the setting or bypassing around the stoker edges. This causes trouble in three ways (1) the meter indicates higher excess air than actually exists in the fuel bed, leading to reduction in the air supply and the troubles that grow out of a hot fuel bed, (2) the increased dry-gas loss reduces boiler efficiency, and (3) the leakage air puts more load on the induced-draft system.

The cure for air leakage is simple: with draft on the boiler, check the suspected spots with a lighted candle. Usual danger points are expansion joints in brickwork, places where boiler drums, waterwall circulators, waterwall headers, superheater tubes or headers, etc, pass through brickwork, places where brickwork is built around columns or beams, joints in steel casings, joints between waterwall casings and brick walls, places where waterwall headers or other waterwall structures extend from ashpits to other parts of the setting, setting doors and frames, and wall sleeves for soot blowers. Small cracks can be sealed with a compound made of long-fiber asbestos and a bituminous binder; cracks wider than 1/8 in. should be plugged with asbestos rope and then plastered over with sealing compound.

When measurement of air flow depends on use of the boiler passes for an orifice, as in the case of some steam-flow air-flow meters, heavy incrustations of slag can materially reduce the size of the "orifice" and thus cause misleading readings of air flow. The answer preferably lies in keeping boiler surfaces free of such heavy slag coatings but where this condition exists and cannot be avoided, allowance should be made in interpreting air-flow measurements.

Operation at ratings higher than normal may overload the induced-draft system. If the combustion products cannot be removed as fast as they are generated, pressure will build up in the furnace. In such cases, the operator may be tempted to cut the air supply to the fuel bed, thus reducing the volume of combustion products to conform with the capacity of the induced-draft system. This brings with it all the troubles that follow operation with insufficient excess air: overheating of grate structures and furnace walls, clinkering, and smoke. The proper answer lies in getting more capacity out of the induced-draft system by the methods outlined in POWER, February, 1942, pg. 57.

Intelligent operation depends on exact knowledge of what is happening in the fuel bed and furnace. Obervation of the fire is necessary, but not enough; instruments must be provided to measure factors that are not visible. For good stoker operation, the operator should be guided by: (1) an indicating gage for air pressure under the stoker, to detect changes in fuel-bed conditions before they can be spotted by eye, (2) an indicating gage for furnace draft to permit intelligent regulation and to minimize infiltration of cold air through unavoidable leaks, (3) an indicating gage for outlet draft, to indicate changes in air flow and to check the operation of the boiler damper, which usually cannot be seen, (4) a meter recording steam flow, to show load changes, (5) a meter recording air flow, either by direct measurement or by measurement of CO_2, and (6) an instrument recording temperature of stack gas, to check boiler cleanliness and effectiveness of baffles. Best results are obtained when these necessary guides to operation are mounted on a single panelboard, convenient to the boiler-room operator.

Stoker Fuel Situation

War conditions turn the normal fuel picture upside down. Usually, operators select the coal that will give lowest over-all steam cost, even though it may have undesirable burning characteristics. Now, with capacity the vital factor rather than economy, many operators will turn to the so-called "premium" coals, those with desirable operating characteristics. Where such coals are available, their use is indicated if specific troubles, such as clinkering, limit capacity.

Thus it would seem that emergency conditions put greater emphasis than ever on coal selection, the major difference being that now maximum performance is sought rather than maximum economy. This probably will be the case for a while, but if the fuel and transportation situation tightens measurably, choice of coals may be decidedly limited. If any shortage in transport appears, a probable first step would be restriction on long hauls for bulk materials such as coal; this means using local fuels regardless of their characteristics. The problem thus becomes one of being ready to handle the worst coal that might be received.

Many of the changes described on preceding pages will help in handling poorer coals. For example, installation of waterwalls will reduce clinkering tendencies of low-fusion coals, and overfire air will reduce smoke and cinder loss likely to result if high-volatile coal is burned in a small furnace.

Acknowledgements

POWER wishes to acknowledge the assistance of the following companies and individuals, who furnished many of the ideas in this special section: W A Hanke, *American Coal Burner Co;* F X Gilg, *Babcock & Wilcox Co;* L C Dubs, *Canton Stoker Corp;* G P Jackson, *Combustion Engrg Co;* H C Carroll, *Commercial Testing & Engrg Co;* R S Clark; R L Beers, *Detroit Stoker Co;* R H Lamb, *Flynn and Emrich Co;* A L Brice, *Frederick Iron & Steel Co;* Paul Kautz, *Illinois Stoker Co;* T A Marsh and R C Wright, *Iron Fireman Mfg Co;* H H Fleming, *Johnston & Jennings Co;* F G Treat and Ollison Craig, *Riley Stoker Corp;* E R Stone and H E Bacon, *Westinghouse Electric & Mfg Co.*

Deaeration Increases pH

Deaeration to eliminate dissolved oxygen also markedly increases pH value by removing "free CO_2", thus giving further protection against corrosion. This paper by J D Yoder, Permutit Co, was first presented last November at a meeting of the Engineering Society of Western Pennsylvania

▶ DEAERATION OF boiler feedwater generally implies the removal of oxygen, which is the active agent of oxidation or corrosion in feed lines, high-pressure heaters, economizers and boilers. Deaeration also substantially increases pH value, which is important, because low pH accelerates corrosion.

Low pH is caused by free mineral acidity and gases that have the property of dissociating hydrogen ions. The addition of excess alkali, such as caustic soda or soda ash, will increase the pH to any desired value. However, excessive alkaline treatment increases the total solids. Accordingly, it is good practice to neutralize the free mineral acidity, provide the smallest possible excess of alkalinity that will definitely prevent free acidity at all times, and depend upon efficient deaeration to remove the gases that cause low pH.

Carbonate Ionization

CO_2 is practically the only gas found in feedwater that produces low pH. This combines with water to form carbonic acid (H_2CO_3). The CO_2 may be present naturally in excess of the HCO_3 equivalent to the total alkalinity of the water, but H_2CO_3 (commonly called *free CO_2*) also results from the continuous dissociation of CO_3 and HCO_3, which are maintained in equilibrium subject to the laws of mass action.

Physical chemists have determined the constants for such dissociation in dilute solutions. These constants vary with temperature and other conditions. MacInnes and Belcher[1], and Langelier[2] have discussed fully the equilibria equations and the derivation of the constants. Camp[3] substituted established constants for room temperature in these equations, and plotted the curves for varying pH values, reproduced in Fig. 1. These curves are presented for those who desire to determine the extent of this dissociation at various pH values.

From Fig. 1, at a temperature of 18 C (65 F), and pH 8.3, the molecular ratio of HCO_3 to H_2CO_3 is approximately 60. Accordingly, the water under these conditions would have H_2CO_3 (free CO_2) equal to slightly less than 2% of the HCO_3, with a proportional decrease of HCO_3.

The customary (APHA) method of

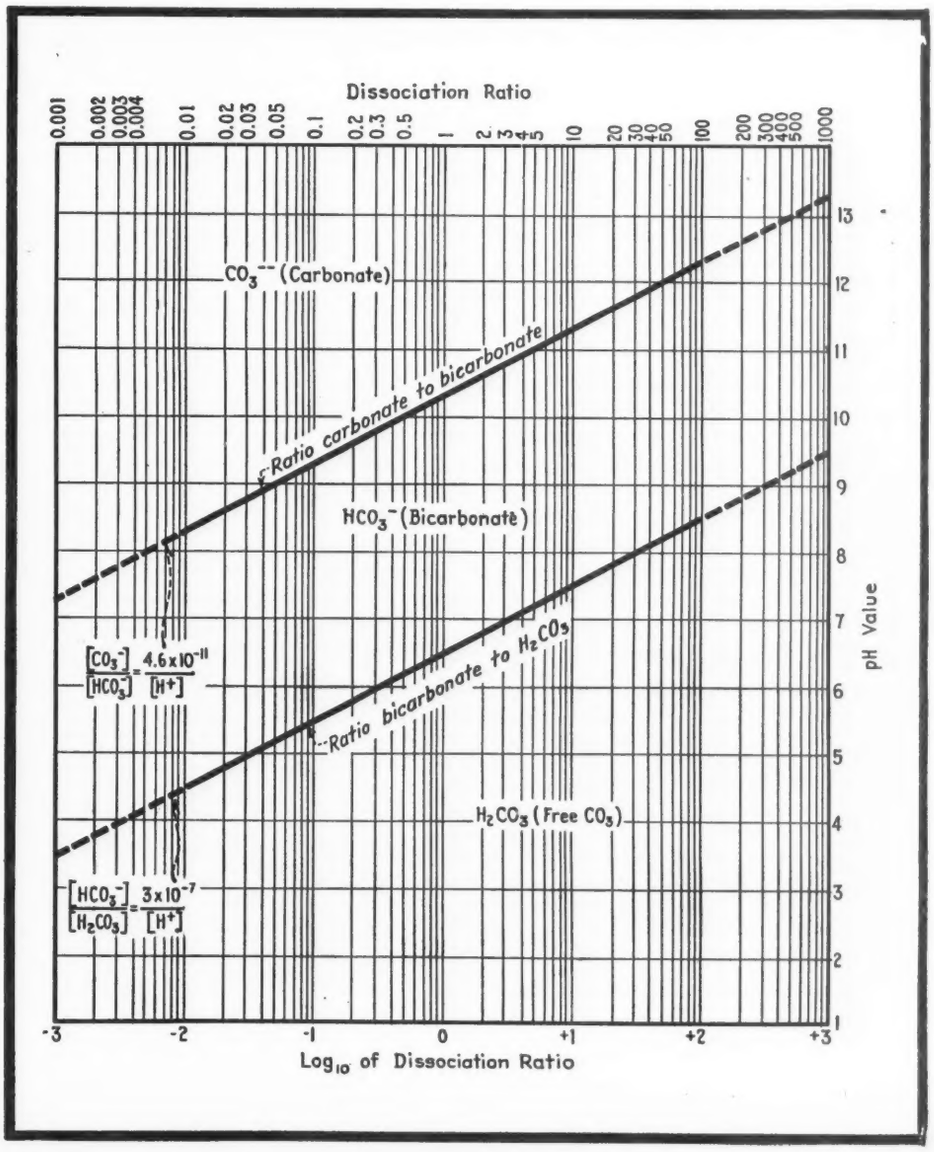


Fig. 1—Carbonate ionization in solutions at a temperature of 18 C

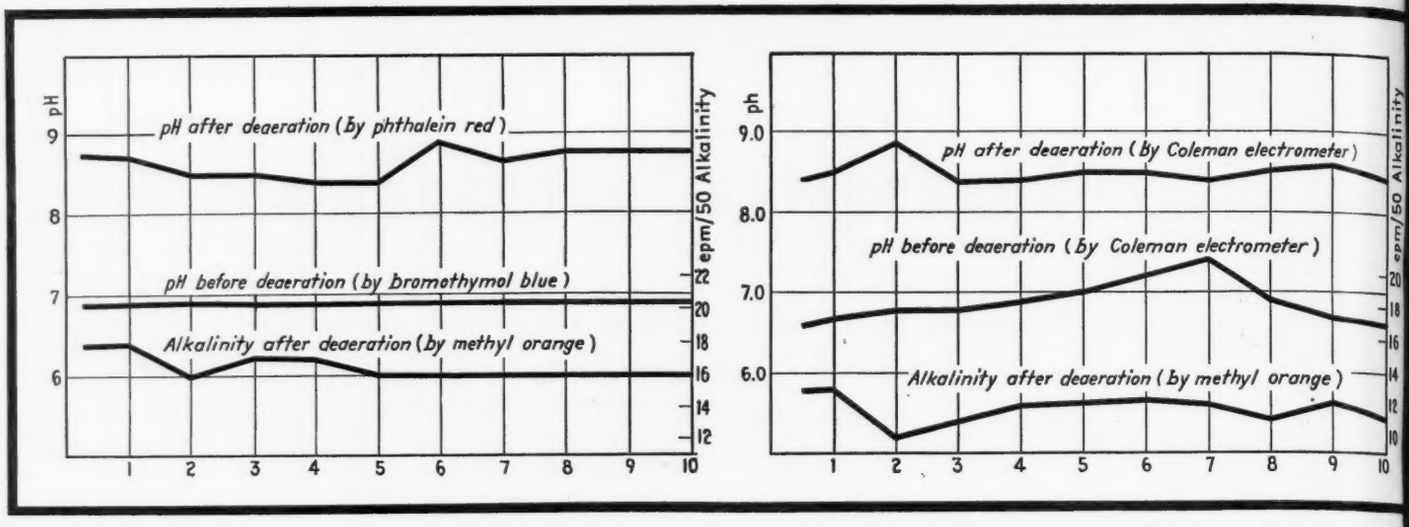


Fig. 2—Case 1: Effect of deaeration on pH. Deaerator capacity 1,400,000 lb per hr. Steam pressure 14 lb gage

Fig. 3—Case 3: Same as Fig 1, but for a 200,000 lb-per-hr deaerator operating at 5 lb gage

determining free CO_2 would indicate zero free CO_2 at pH 8.3, whereas if this water had a total alkalinity (methyl-orange indicator) of 100 *epm/50** it would actually have 3.2 epm/50 of H_2CO_3, 94.9 epm/50 of HCO_3 and 0.9 epm/50 of CO_3. (For explanation of epm/50 see bottom note.—Editor)

McKinney[4] has developed equations for calculating from data at room temperature the distribution of the ions for any temperature. Amorosi and McDermet[5] have calculated the necessary constants for higher temperatures, and have applied these in detail to the performance of a deaerating feedwater heater.

It is of little value to know the extent of dissociation of the CO_3 radical, because if the total CO_2 has been determined by any suitable method, more or less dissociation of the CO_3 radical will neither increase nor decrease the total CO_2 present. The essential factors are the amount of oxygen, the pH and the total CO_2. With given amounts of oxygen the tendency to corrosion is determined by the pH value and the temperature. The total amount of CO_2 in the water is of importance because this determines the amount that may be given up by the boiler with the steam to cause corrosion of condensate return lines.

It therefore follows that the pH of the water, the total CO_2 and the oxygen, are the important items in determining the suitability of feed water from the standpoint of corrosion of boilers, feed and condensate lines.

Titration of water samples with standardized acid solution for determination of CO_3 and HCO_3, and standardized alkali solution for free CO_2, is generally acceptable, although some engineers prefer other procedures. While it is not necessary to determine the extent of this dissociation of the CO_3 radical as a measure of its tendency to corrode, it does have an important bearing on results in practice.

Why Deaeration Raises pH

Without such dissociation the boiler would not give off free CO_2 beyond the amount originally in the feedwater; experience has shown that enough CO_2 is driven off in the boiler to remove all HCO_3 and approximately 80% of the CO_3 as determined by the customary titration method, using phenolphthalein and methyl-orange indicators. Actually this residual carbonate radical in the boiler is also dissociated to equilibrium with HCO_3 and H_2CO_3, even though the water in the boiler may have a pH of 11.5 or higher.

It would be impossible to raise the pH of water above 8.3 by deaeration were it not for the dissociation of the CO_3 radical. Experience has again shown that efficient deaeration may raise the pH of a water from less than 7 to more than 8.4 to 9.2, depending upon the steam pressure and the alkalinity of the water.

Free CO_2 is a gas and is removed from the water by deaeration the same as oxygen or any other gas. The more CO_2 removed the higher the pH becomes and the more efficient the degasification. The increase in pH value of the water is frequently a more accurate measure of deaeration efficiency than the measurement of the exceedingly small quantities of oxygen found in the water from a modern deaerator.

More Sensitive

For instance, a deaerator may produce a water showing zero oxygen by the Winkler test, with a pH 8.3. More efficient deaeration may increase the pH to 9.2 or higher without any measurable improvement in removal of oxygen, because the amount of oxygen measured throughout the pH range 8.3 to 9.2 may be below the amount that can be determined accurately by the accepted Winkler method.

Some illustrations will be given of results obtained from commercial installations, to show how much pH is increased by deaeration.

Fig. 2 shows the methyl-orange alkalinity of water leaving the deaerator, and the pH of the water before and after deaeration. The water entering the deaerator was approximately 75% makeup from a zeolite softener and 25% condensate, including exhaust steam for heating the water and some condensate from a surface condenser.

Note that with average alkalinity of approximately 16 epm/50 the pH was increased from 6.9 to an average of about 8.6.

These curves were plotted by taking samples of deaerated water at intervals of approximately 45 min. At the time of these tests this deaerator had been in service for about two years, 24

*** The reader will note Mr Yoder's frequent use of the expression "epm/50". This unit is one fiftieth of one equivalent per million. Therefore values expressed in this unit are numerically equal to values in parts per million multiplied by 50. Since the equivalent weight of calcium carbonate is 50, values in terms of epm/50 are the same as the equivalent ppm of calcium carbonate, in terms of which hardness and alkalinity are commonly expressed.**

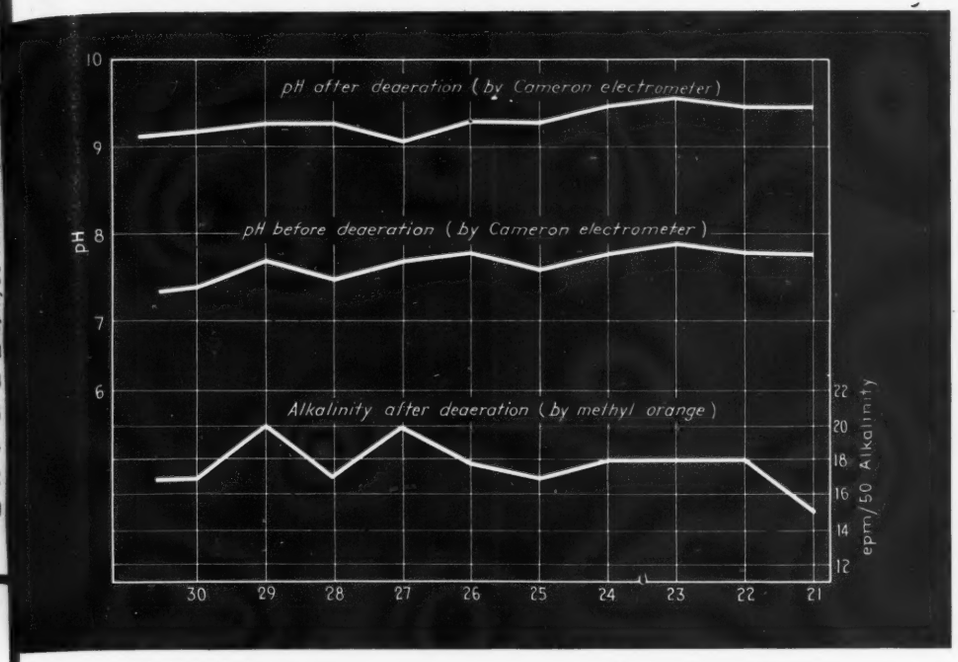
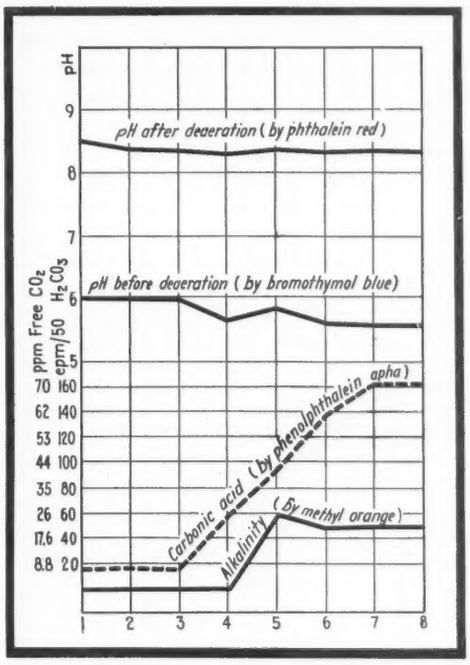


Fig. 4—Case 2: Same as Fig 1, but for a 200,000 lb-per-hr deaerator operating at 28 lb gage

Fig. 5—Case 4: Effect of deaeration on pH, where "free CO_2" of inlet water was artificially built up



hours per day, without time lost for maintenance or inspection, illustrating the sustained efficiency of modern deaerating equipment when the properly conditioned water is used.

Fig. 4 gives similar data for an industrial plant with deaerator capacity of 200,000 lb per hr, and approximately 50% makeup, treated by a Zeo-Karb H and Na softener. The steam pressure is in part responsible for the high pH of water after deaeration. The higher the steam pressure, and therefore the temperature, of the deaerated water, the greater will be the dissociation of the CO_3 radical. This increases the percentage of H_2CO_3 and therefore permits the deaerator to remove more free CO_2, which in turn increases the pH value. The curves are typical of daily performances.

Fig. 3 gives similar data for another 200,000-lb-per-hr deaerating heater at an industrial plant having 40% makeup from a Zeo-Karb H softener, with neutralization of the slight mineral acidity of the Zeo-Karb H effluent with caustic soda and trisodium phosphate. These curves were plotted from daily log sheets for ten consecutive days.

The pH of this plant was not as high as for Fig. 4, probably for two reasons. (1) Steam pressure was 5 lb, compared with 28 lb for Fig. 2. (2) Total alkalinity in Fig. 3 varied from 10 to 12 epm/50, compared with 17 to 20 epm/50 in the case of Fig. 4 above.

Figs. 2, 3 and 4 represent results obtained under normal daily operating conditions with no change in operation for obtaining the desired data.

Fig. 5 represents results obtained with a 60,000-lb-per-hr commercial deaerator with a change in operation to determine the deaerator capacity for removing greater quantities of free CO_2. At this plant the makeup is 100%, less only the steam condensed in heating the water in the deaerator. The steam pressure in the deaerator was one pound. The softening plant combined Zeo-Karb H and Na units in parallel. Water from the Zeo-Karb H unit had some free mineral acidity and free CO_2, while that from the Zeo-Karb Na unit was relatively high in sodium-carbonate alkalinity. These two effluents were mixed in proportions to give an alkalinity between 4 and 10 epm/50. Such mixing of water having sodium-carbonate alkalinity with a water of free mineral acidity produces a substantial amount of free CO_2, ordinarily removed by passing the mixture downward through a degasifier over staggered trays while air is blown through the degasifier counter-current to the water flow.

For the purpose of this test the air blower was stopped, so that most of the free CO_2 was carried through to the storage tank. This caused the free CO_2 to build up gradually in the storage tank from 8 to 72 ppm, or the equivalent of 18 to 163 epm/50 H_2CO_3 as indicated by Fig. 5. The pH varied between the limits of 6.0 and 5.6 with a methyl-orange alkalinity between 4 and 9 epm/50.

This case shows that a properly designed deaerating heater can remove large quantities of free CO_2. Here 72 ppm free CO_2 were removed and the pH of 8.4 after deaeration is entirely satisfactory for boiler feed. It might appear that the degasifier commonly used after acid treatment of an alkaline water could be omitted. However, water having 70 ppm of free CO_2 would be quite corrosive to the piping, vent condenser, and deaerator parts ahead of the spray. Where the alkalinity before acid treatment is relatively low, a degasifier can economically be omitted. However, if the water has more than 20 or 30 ppm of free CO_2, special provision must be taken to prevent piping corrosion. It therefore is a question of economics whether to use a degasifier or make the deaerator heater of special materials to resist corrosion.

1. D A MacInnes, *The Principles of Electro Chemistry*, Reinhold Publishing Corp, New York.
2. W F Langelier, *Journal* AWWA Vol 28, p 1500
3. Prof T R Camp, Mass. Inst of Technology, *Notes on Sanitary Engineering, 1933*
4. D S McKinney, The Calculation of Equilibrium in Dilute Water Solution, *Proceedings* ASTM 39, 1191 (1939)
5. A M Amorosi and J R McDermet, The Calculation of the Distribution of Carbon Dioxide Between Water and Steam, *Proceedings* ASTM 29, 1204 (1939).

What Will 1943 Turbines Be Like?

Looking back over turbine orders for nearly four million kilowatts of steam capacity, F K Fischer and J R Carlson of Westinghouse here tabulate sizes and types of turbines that will power the ever-growing battle of production

▶ To ASSURE ADEQUATE power supply for coming years of war effort, orders for over 3,825,000 kw of turbine-generator capacity in units of 10,000 kw and larger were placed during a 12-month period from November 1940 to November 1941. Most of these are for central-station service and marked for delivery during the next two years.

This total capacity is divided among 104 units, an average of 36,800 kw each. An analysis of their characteristics, tabulated on the facing page, can be taken as indicative of trends in design and plant practice.

Breakdown by size of unit, pressure, temperature, generator coolant, speed and type of turbine (condensing or non-condensing) shows the number and proportion of machines and kilowatts in these respects. A brief table summarizes the results. Three-fourths of the turbines will operate at 3600 rpm and over half will be hydrogen cooled. Less than one out of ten are for superposition, and even these are small.

Standard Units

In addition to the facts of the tables, the preparation for war loads has caused certain other trends. Some of the power companies have been forced to depart from the practice of purchasing highly standardized machines that are essentially duplicates of previous installations. This has been brought about by the necessity of adding large blocks of power equipment to meet rapidly climbing loads. Three 150,000-kw machines ordered from Westinghouse during this period are typical of the demand for larger sizes. These are the largest units that have been ordered since 1932.

Of the three, two are cross-compound units with a maximum rated output of 187,500 kw at unity power factor. Each unit consists of a non-condensing high-pressure element of 65,000-kw capacity exhausting into a low-pressure element of 85,000-kw. Design steam conditions are 850 lb, 900 F and 1 in. Hg condenser pressure. Four extraction stages for feedwater heating are provided. To keep parts in contact with high-temperature steam as small as possible, the high-pressure elements are 3600-rpm machines.

The maximum speed for the low-pressure elements was limited to 1800 rpm for two reasons (1) inability to obtain sufficient exhaust area in a double-flow 3600-rpm turbine and (2) impracticability of building an 85,000-kw, 106,250-kva 3600-rpm generator. However, generators for both high- and low-pressure elements will be hydrogen cooled. Direct-coupled exciters supply excitation for each generator with a

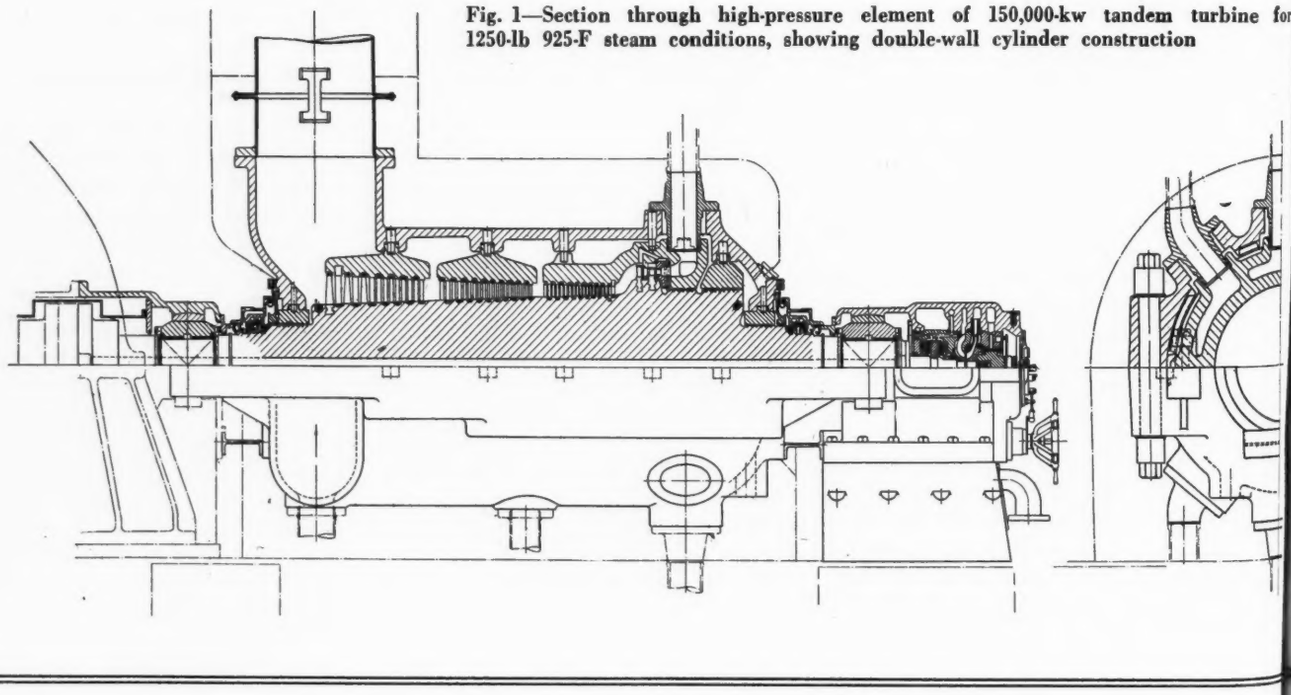


Fig. 1—Section through high-pressure element of 150,000-kw tandem turbine for 1250-lb 925-F steam conditions, showing double-wall cylinder construction

motor-generator set for emergency needs.

The other 150,000-kw machine, a single-shaft tandem-compound unit, runs at 1800 rpm and is designed for 1250-lb 900-F steam conditions. Steam will be extracted at five points for feed heating. The generator will be hydrogen cooled and the exciter direct coupled.

To minimize the effect of thermal distortion inherent in thick cylinder walls of earlier large 1800-rpm machines built for high-temperature steam conditions, the high-pressure cylinder will consist of two casings, one within the other. The steam space between the two casings, Fig. 1, is subjected to a pressure which varies with flow through the turbine but which is always materially lower than throttle pressure. Thus each casing need be designed for only part of the differential between throttle and atmospheric pressures. Resulting thinner cylinder walls and smaller flanges, together with the fact that the inner casing is kept at a relatively constant high temperature during operation, minimize temperature distortion.

Among other significant developments of the year not reflected in the table is the initial operation of two 65,000-kw superposed turbines, largest yet built. Of these, the 1250-lb 925-F Westinghouse unit has a generator rating of 81,250 kva at 0.8 power factor with ½-lb hydrogen pressure. This generator also has a flexibly mounted stator core.

Other interesting aspects of turbine development are illustrated on pages 87 and 90 of this issue. Use of models to guide and coordinate the engineers in developing functionally correct design has also helped produce generating units that are pleasing in appearance. Improvement in streamlining has been obtained by using smooth surfaces and rounded corners. Such changes have been made without any sacrifice in the accessibility of parts for maintenance.

The inside working parts have not been neglected. High-pressure superposed operation has demanded greatly increased duty of the first-stage blading. For over a year, experimental studies on a single-stage 10,000-kw turbine, page 90, have resulted in measured and charted blade vibration. This turbine, the equivalent in size of the first stage of a 50,000-kw superposed unit, is equipped with mirrors and an optical system through the hollow shaft that permit observation and photographing of actual blade vibrations under service conditions.

Steam at 1200 lb and 900 F comes from an existing boiler in an operating station. Two miles of film have been used in making more than 70,000 photographic blade-vibration records.

Although the work is not complete, much has been accomplished in that it is no longer necessary to grope in the dark for safe blade structures. Sufficient data have been accumulated and analyzed to make possible definite predictions concerning the success or failure of specific impulse-blade designs. As a result, large superposed turbines can now be built with assurance that their reliability will be comparable with that of condensing units.

BRIEF DATA ON 104 TURBINES

25,000-kw turbines lead all the rest. Of 104 total, 19 are of this size, 13 are 35,000 kw and 12 are 50,000 kw

850-lb pressure was selected for 45% of the units

900-F temperature units exceed any other class by three times; over half use this temperature

3600-rpm machines lead at 77%; only 14% are straight 1800-rpm units. In ratings up to 60,000 kw the higher speed has practically replaced the lower

3600–1800-rpm cross-compound combinations total seven units

61% of the units and 75% of the kilowatts are hydrogen cooled. All generators below 20,000 kw are air cooled; nearly all above this size are hydrogen cooled

91% of orders are for condensing operation; no superposed turbines over 25,000 kw were purchased

TURBINE-GENERATORS 10,000 KW & LARGER Ordered Between November 1940 and November 1941

	Size in 1000 kw	10	12.5	15	20	25	30	35	40	50	60	75	80	85	150	Total No.	%	Total kw	%
	Number	12	4	8	11	19	4	12	4	13	4	2	3	5	3	104	100.0	3825	100.0
	Total, 1000 kw	120	50	120	220	475	120	455	160	600	240	150	240	425	450	...	.....	.....	.....
Pressure	450 & lower	2	1	2	5	1	2	...	...	2	...	...	...	...	...	15	14.4	347.5	9.1
	451– 650	8	...	3	2	6	...	2	...	2	...	...	...	...	...	23	22.1	485	12.7
	651– 850	1	2	2	3	10	2	10	2	7	2	2	2	...	2	47	45.2	1945	50.9
	851–1450	1	1	1	1	2	...	1	2	1	2	...	1	4	1	18	17.3	962.5	25.1
	1451 & above	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1.0	85	2.2
Temp	750 & lower	5	1	2	4	1	2	...	...	2	...	...	...	...	...	17	16.3	357.5	9.4
	751– 825	7	...	4	3	4	...	...	...	1	...	...	...	...	...	19	18.3	340	8.9
	826– 900	...	3	2	4	13	2	11	3	8	4	2	3	...	2	57	54.8	2367.5	61.9
	901– 950	...	...	...	...	1	...	2	1	1	...	...	...	4	1	10	9.6	675	17.6
	951–1000	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1.0	85	2.2
Speed	1500	...	...	...	1	...	1	...	...	...	...	...	...	...	...	2	1.9	50	1.3
	1800	...	...	...	1	...	1	...	...	4	3	2	3	...	1	15	14.4	970	25.4
	3600	12	4	8	9	19	2	13	4	8	1	...	...	...	...	80	77.0	2080	54.4
	(1800 lp) (3600 hp)	...	...	...	...	...	...	...	...	...	...	...	...	5	2	7	6.7	725	18.9
Turb Gen	Hydrogen	...	...	...	4	19	2	13	4	9	1	...	3	5	3	63	60.6	2855	74.6
	Air	12	4	8	7	...	2	...	...	3	3	2	...	...	...	41	39.4	970	25.4
	Condensing	10	1	6	11	17	4	13	4	12	4	2	3	5	3	95	91.4	3687.5	96.4
	Non-cond	2	3	2	...	2	...	...	...	...	...	...	...	...	...	9	8.6	137.5	3.6

Compressed Air Provides Twenty-One Flexible Services for Office Building

Piped to all parts of the Metropolitan Life building, air at several pressures actuates radiator valves, powers dampers, blows soot and even sprays mouth wash, insuring simple, dependable power and control for hundreds of applications

▶ The Metropolitan Life Insurance Co office buildings occupy two city blocks between Madison and Fourth Avenues at 23rd and 25th Streets in New York City. The buildings, which include a tower approximately 50 stories high, contain 2,183,606 sq ft of usable floor space to provide working facilities for approximately 15,000 employees. Part of this space is used for one of the most up-to-date kitchens in the world and employee lunch rooms which will accommodate 4,000 persons at one time. Rest rooms and recreational facilities are also provided for the employees. Compressed air serves throughout, being piped to parts of all buildings.

Two Separate Systems

The buildings are divided into two groups known as the main building and Units 1 and 2. The main building contains two compressed air systems, one for 100- and the other for 50-lb service. The 100-lb system consists of three compressors, plus receiver capacity. One of these is a single-stage 12¼ x10-in. 300-cfm reciprocating unit driven by a 75-hp, 230-volt, 850-rpm dc motor normally operated on a start-and-stop basis, depending on system requirements. Two separate air-pressure-control units are installed on this compressor, one of which starts the compressor at 82 lb and shuts it down when the pressure reaches 100 lb; the other is adjusted to maintain 50-lb pressure on the system. Either pressure service can be maintained by changing the position of a switch; the loading also can be regulated by a mechanical air-pressure-controlled unloader while the unit runs continuously.

Emergency standby protection is provided by two vertical locomotive-type 15x12-in. 150-cfm steam-driven compressors. No governors are used with these compressors other than the governing action introduced by piston design. This limits the output against a pressure that requires more power than the steam cylinder is capable of producing at normal steam pressure.

The 50-lb system is supplied by two compressors, one steam and the other motor driven. The unit driven by a cross-compound steam engine is a single-stage duplex 200-rpm 16x23-in. 1500-cfm compressor. This machine operates continuously and its speed is controlled by the delivery air pressure. Three separate governors are provided: a mechanical governor for overspeed protection, another controlled by air pressure for engine-speed regulation, both controlling the common high-pressure steam cylinder throttle valve; the remaining governor, also actuated by air pressure, controls the admission of live steam to the low-pressure cylinder. The action of this last governor prevents the unit from stopping on dead center when extremely low system requirements result in low compressor speeds.

The other compressor, which is a single-stage 13x12-in. 350-cfm unit, is driven by a 275-rpm 230-volt 75-hp dc motor. As originally installed this unit operated on an automatic start and stop basis, but operation under these conditions put a severe strain on the motor. To alleviate this the engineers designed and attached a device which loads or unloads the compressor by controlling the inlet valve. This permits the compressor to run continuously.

With the exception of the two locomotive-type 100-lb units, all compressor cylinders are water cooled, with water piped to and from the cylinders so it can be discharged directly into the general service water tank. No aftercoolers are used, the air being carried directly to receivers before being distributed.

To permit tying the 100- and 50-lb systems together, a 4-in. line, controlled by a pressure-reducing valve, can be placed in service during inspection of the 50-lb compressors. The two systems

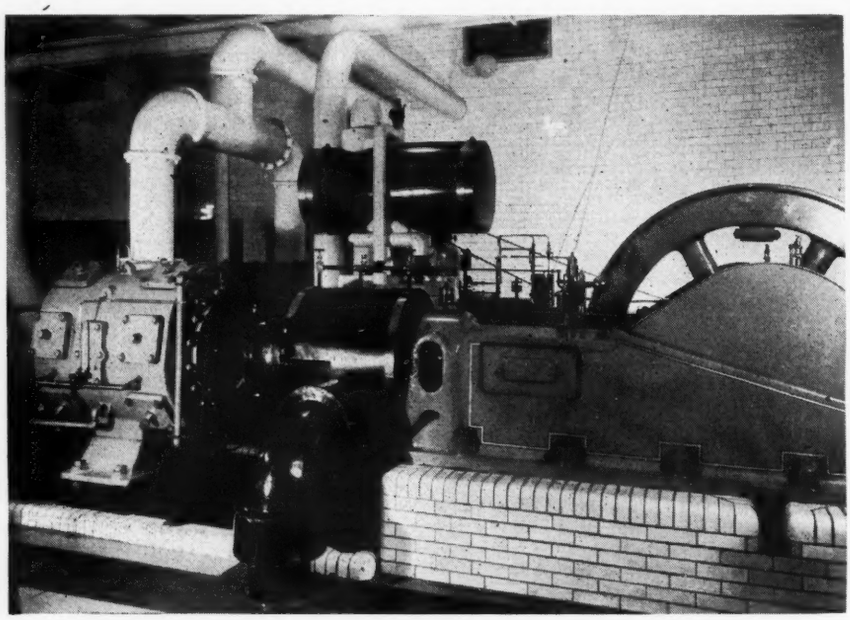


Fig. 1—Cross-compound-engine-driven compressors; the low-pressure-cylinder live-steam-admission governor can be seen near the flywheel rim

can also be tied together through a manually operated valve and check. This line is used only for night service to supply the 100-lb system with 50-lb air, which permits shutting down the 100-lb compressor during the night.

Building units 1 and 2 are served by three single-stage 270-rpm 100-lb compressors, one rated at 422 cfm and two at 355. Each is driven by a 60-hp 208-volt 1160-rpm 3-phase 60-cycle wound-rotor induction motor. These compressors are provided with unloading features to permit continuous operation but are normally operated intermittently by an air-pressure controller. Two controllers are provided, one for 90-lb operation and the other for 60-lb. The compressor cylinders are all water cooled, with the cooling water being discharged either to the service tank or to waste. No aftercoolers are used and the air is piped directly to receivers on the distribution system.

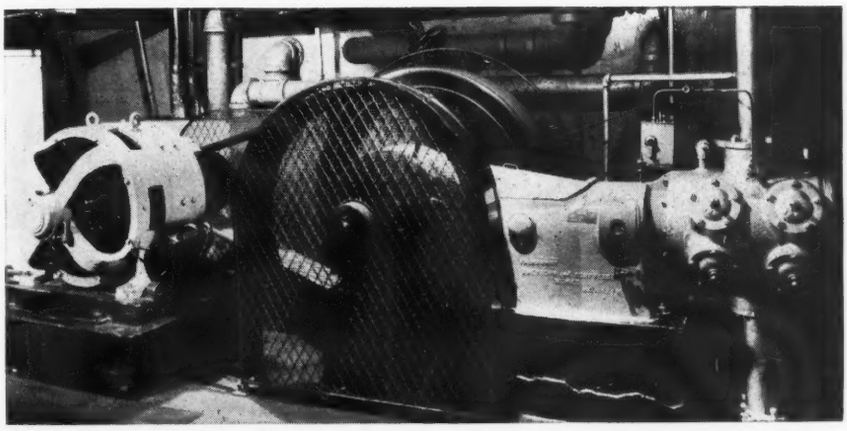


Fig. 2—This unit furnishes 100-lb air for mechanical tools in the main building

A 3-in. tie line connects this plant with the 100-lb system in the main building, which increases the flexibility and permits operating the group as a unit or as backup protection for each section during heavy air demands.

The population of these buildings, which in size is comparable to that in many towns, requires numerous services in order that the organization may function smoothly. Using compressed air as the master servant for controlling temperatures and pressures simplifies the maintenance procedure so that there is a minimum of interlocking mechanical and electrical maintenance on any one piece of operating equipment. This allow more flexibility between the two departments and gives a more specific division of equipment to each department for inspection purposes.

The 100-lb air is used for boiler-room service, the operation of jack hammers, heavy drills, power hacksaws, grinding wheels and for blowing dust from motor windings. When necessary it is also used for sand blasting. The pressure on the 100-lb system varies from 82 to 100 lb and the boiler-room pressure is maintained at the full 100 lb by a 30-cfm booster compressor driven by a 2½-hp 240-volt 1400-rpm automatically controlled dc motor. This compressor discharges directly into its own receiver and the air is then piped to the soot blowers and oil burners. At the oil burners it is used to remove remaining oil after the burner is shut off. Cleaning the boiler tubes with air has proved more satisfactory than with steam. The assistant chief engineer began using compressed air for soot blowing in 1910 and has found it superior to steam in many ways. Moisture in steam tends to form a crust over the surface of the soot making it very difficult to remove. There is also the possibility of the moisture combining with sulphur gas and forming a corrosive mixture which will attack metal parts.

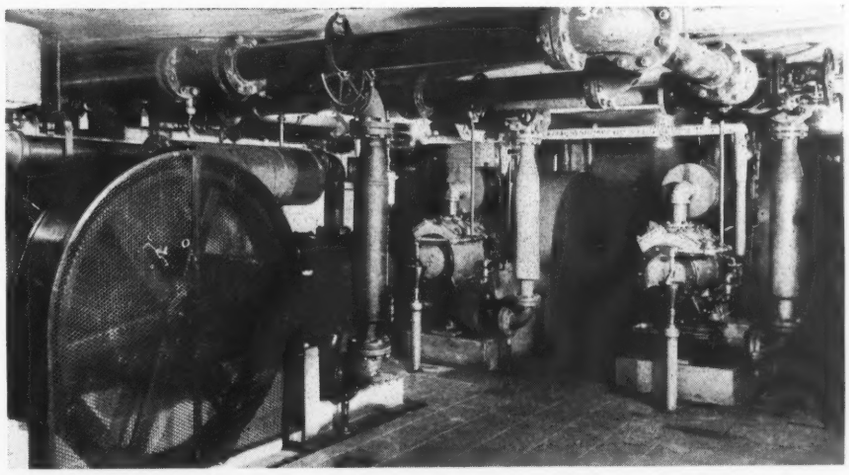


Fig. 3—Open funnels in front of the cylinders are used to check cooling-water flow

In both buildings the 50-lb air is reduced to pressures ranging from 13 to 32 lb, depending on the service. Perhaps the largest amount in both buildings is that used for sewage ejection. As the subbasement floors are considerably lower than the main sewage outlet, 15-lb air is used for the ejectors in the main building and 40-lb air is required for the ejectors in building units 1 and 2.

In the engine room the steam-engine generator sets are equipped with load alarms which sound when a unit reaches full load. A lever connected to the governor flyball operates a valve controlling the flow of air to a small whistle. Reduction of engine speed opens the valve, permitting air flow to sound the whistle.

In the kitchen the soup kettles are kept at the required temperature by using 20-lb air to control diaphragm-operated steam-supply valves. This same type of control is used on the hot-water heating tanks with either high-pressure or exhaust steam. Water for drinking purposes is distributed direct from the city service lines.

Temperature variation throughout both buildings is controlled by air-actuated radiator valves using 13- and 18-lb air. This is carried to a main panel in the engineer's office, where a master control valve is located. Placing this valve in one position admits 13-lb air to the various thermostat supply lines and is used for day service; placing the controller in the other position cuts off the 13-lb and admits 18-lb air to these lines for night service. This higher pressure automatically causes a lower room temperature to be maintained during the night.

In the steam-heating system all pressure-reducing diaphragm-operated valves are controlled by a pressure regulator which controls the admission of 23-lb air to the diaphragm, yielding uniform valve movement. This gives

a quick and positive action to the valve independent of steam pressure. With this arrangement it is possible to operate the reducing valve even when a pressure lower than atmospheric is being maintained on the low-pressure side. Increasing friction, which might otherwise make the valve sluggish, is overcome by using the constant-pressure air as the actuating force.

Steam-pressure indications from heating-supply headers on the upper floors are transmitted to the engineer's desk by an air-actuated instrument. Transmitting pressure indications directly from these elevations requires that the gage be corrected for static head from condensate, or that a continuous bleeding of the condensate be arranged. Transmitting the readings by compressed air eliminates both these troubles.

Air-Conditioning Control

Large air-conditioning units, protected against overspeed by mechanical governors, have their speed regulated by temperature controllers using compressed air to operate the main throttle valves. A steam-jet air-conditioning unit using water as the refrigerant is controlled entirely by compressed air regulating equipment.

Air is also supplied to the dental and medical departments for spray purposes. Other important uses include the operation of elevator gates and ventilating dampers. As a precaution against service interruptions several complete 4-cylinder air motors are kept available to replace electric motors in case of failure. One of these motors can be installed to operate the machine until repairs can be made to the electric motor.

Several unique features which show the ability of the engineering personnel are the devices which they have designed and constructed for control and signal purposes within the plant. Here are two examples: An audible signal between the engine and boiler room is so constructed that when the engineer signals the fireman, this is automatically acknowledged by a return signal sounded in the engine room. Another device installed in the engine room automatically indicates both visually and audibly the water level in a reserve tank placed on the roof. Air is used to operate these devices.

In this plant compressed air has been given an opportunity to demonstrate its possibilities and is producing satisfactory results by providing a flexible, positive and dependable source of power for numerous purposes.

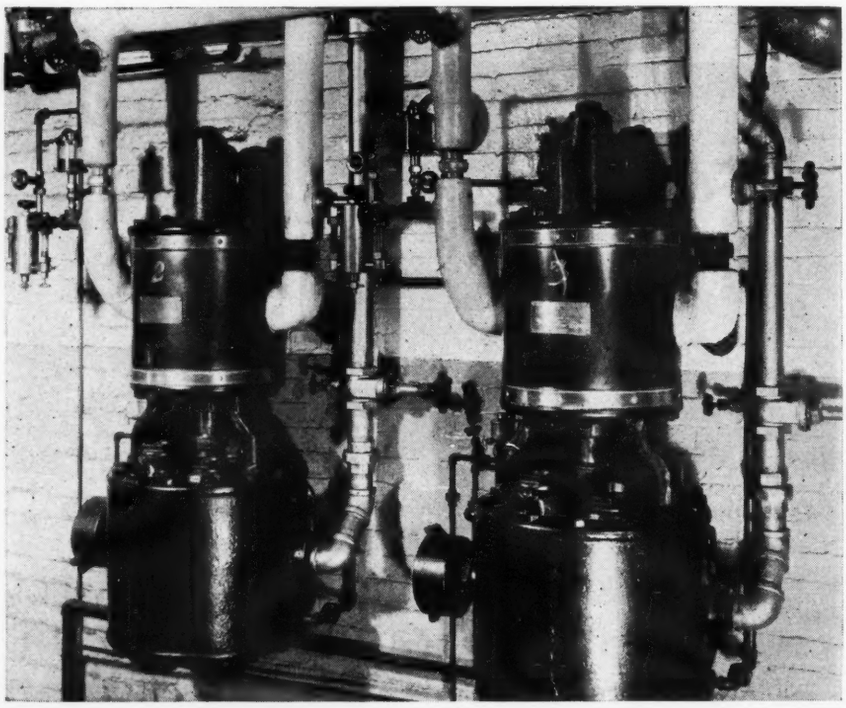
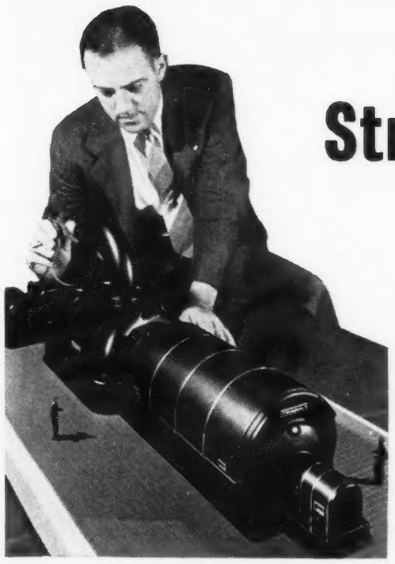


Fig. 4—Locomotive-type vertical wall-mounted units are maintained as reserve capacity

COMPRESSED AIR APPLICATIONS

Service	*Pressure, lb*	*Purpose*	*Remarks*
Steam boilers	100	Soot blowers	Air is used instead of steam for blowing soot
Oil burners	100	Cleaning	Blows remaining oil from tube after burner is shut off
Heavy tools	100	Power supply	Used to operate jack hammers, drills, sand blasting, portable sump pumps, etc
Cleaning	100	General utility	Used for blowing accumulated dust from motor windings
Emergency power	100	Power supply	Spare air motor can be used in case of electric-motor failure
Sewage ejectors	15 & 40	Power supply	Raises sewage to elevation of main discharge
Elevator gates	30	Power supply	Opens and closes elevator car gates
Ventilating system	30	Damper control	Operates dampers in ventilating duct
Refrigeration	30	Protection	Controls reserve water supply and shuts compressor down in case of trouble
Steam headers	23	Power supply	Operates diaphragm-controlled reducing valves
Water level	20	Control	Transmits roof-tank water-level indications to engine room
Engine loading	20	Control	Actuates overload warning signal
Service-water supply	20	Control	Air under float control operates valve in water line
Hot-water heaters	20	Control	Operates steam-supply valve
Signal system	20	Communication	Between engine and boiler room
Kitchen	20	Control	Air pressure regulated by temperature control operates steam valves on soup kettles
Air conditioning	17 & 23	Control	Air pressure regulated by temperature control operates steam-supply valve
Radiator valves	13 & 18	Control	Air pressure under thermostatic control operates radiator steam-supply valves
Remote indication	17	Control	Transmits steam-pressure readings to engineer's office
Dental and medical	15	General utility	Used to operate mouth sprays, etc
Locker room	20	General utility	Air brush for cleaning employees' clothes

Streamlined—Inside and Out

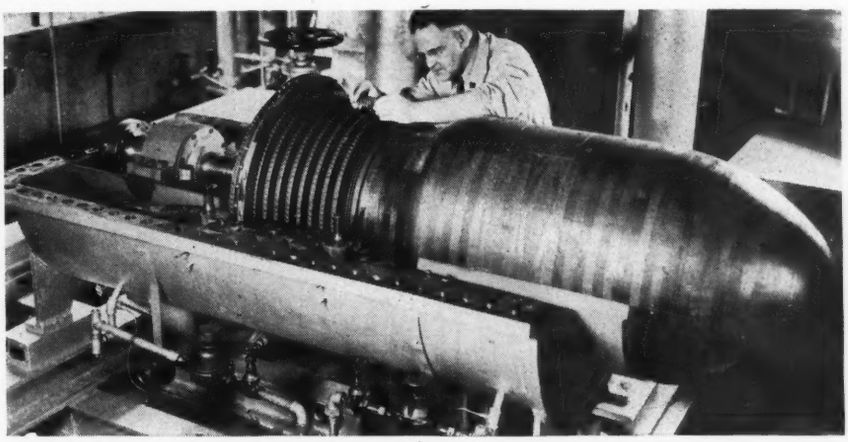


Industrial artists, working with engineers, have developed designs that harmonize with station interiors. D L Hadley, Westinghouse, checks model of a large turbine-generator unit

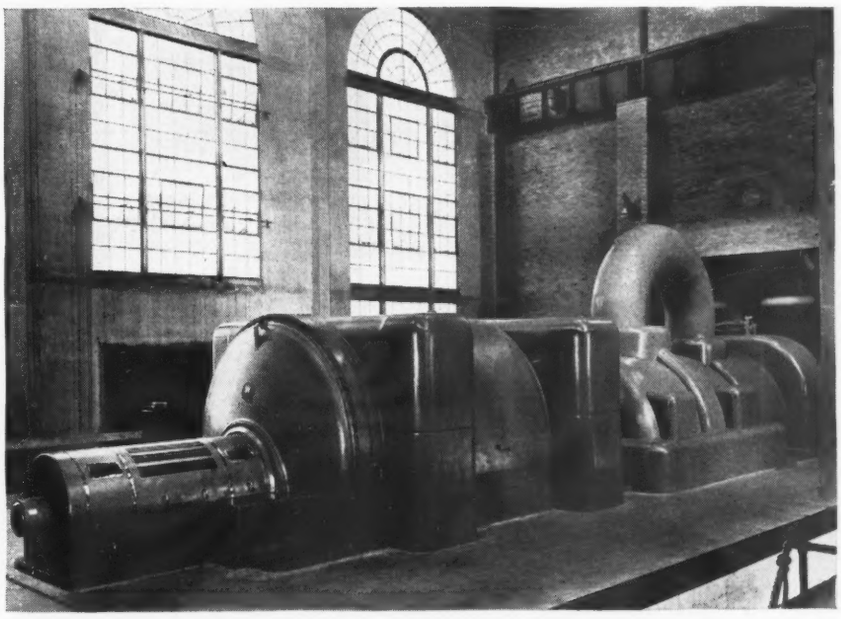
WITH TURBINE ASSEMBLY LINES brimming with production of new power-making units, technical advance goes on behind the scenes in the laboratories and in the nation's newest operating plants. Standardization brings greater production; research shows the way to fewer pounds of strategic material per kilowatt.

Pictures here and on page 90 illustrate the progress in turbine design and construction that goes on day by day without holding up production of standard machines. For example, research developed hydrogen cooling of generators that allows carrying more load on a given size frame. In a single year three-fourths of all large turbine kilowatts were hydrogen cooled, see page 82.

The development and acceptance of the 3600-rpm unit has contributed to the war effort by reducing the total weight of both turbine and generator for sizes over 20,000 kw. Four out of five large units now are designed for the higher speed.



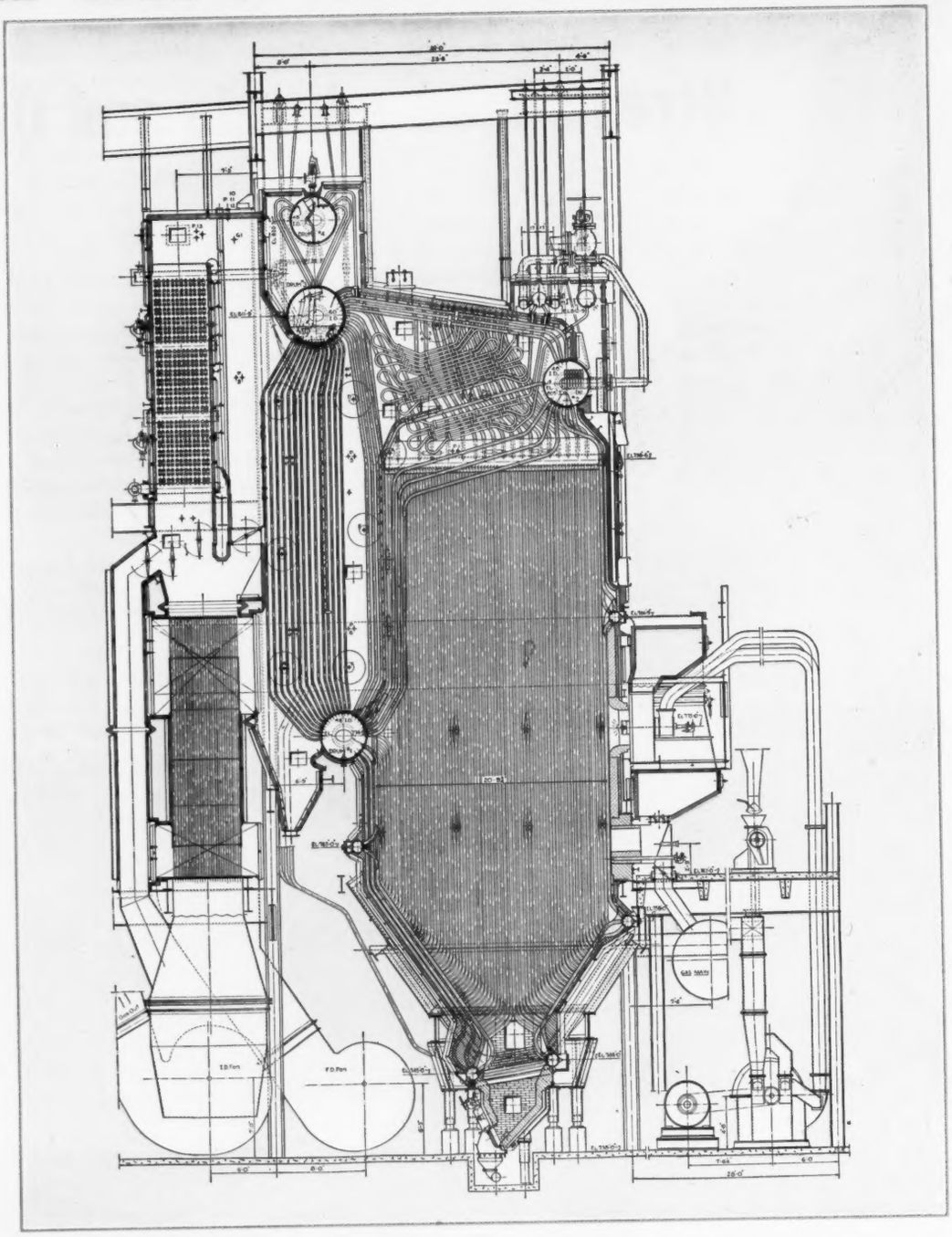
Working with a wind tunnel, in effect an air turbine, Westinghouse engineers are learning more exactly the flow of steam through turbines. Tunnel pressure can be varied from twice atmospheric down to two inches of mercury. Air velocity can be raised to 2200 ft per sec. With tiny search tubes $\frac{3}{32}$-in. diameter, the flow pattern can be fully explored for the stage selected. A plot of this data affords a new and more precise picture of the steam path, which in turn results in more exact design of turbine parts



Functionally correct as well as pleasing in appearance, the finished result of research and production is this 62,500-kva 3600-rpm hydrogen-cooled machine in the Acme station of the Toledo Edison Co. Steam conditions are 820 lb 825 F. Much improvement in appearance has been obtained by using smooth surfaces and rounded corners without any sacrifice in accessibility. Irregular shapes are covered with sheet-metal lagging

(CONTINUED ON PAGE 90)

Iron and Steel Industry's



RILEY STEAM GENERATING UNIT

Capacity—450,000 lbs of steam per hour. Pressure—500 lbs. Steam Temperature—750° F
Fuel—Blast Furnace Gas or Pulverized Coal or combination of these.
Efficiency—85.8% with coal—80.3% with Blast Furnace Gas.
Furnace Width—32'1½" — Furnace Volume—28,000 cu. ft.
Heat Release—21,000 B. T. U. with coal—22,300 B. T. U. with gas.
STONE & WEBSTER ENGINEERING CORP., Engineers

TRADE MARK Rx REGISTERED

RILEY

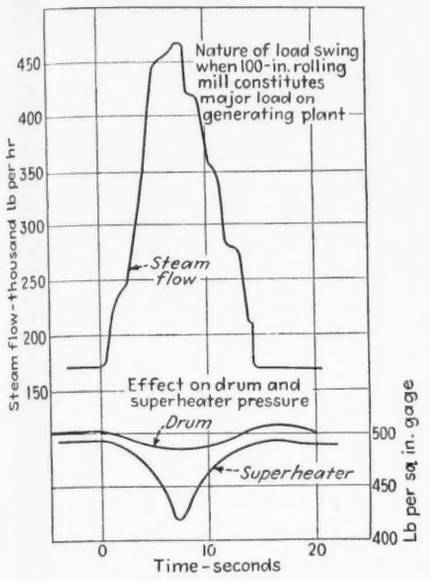
STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

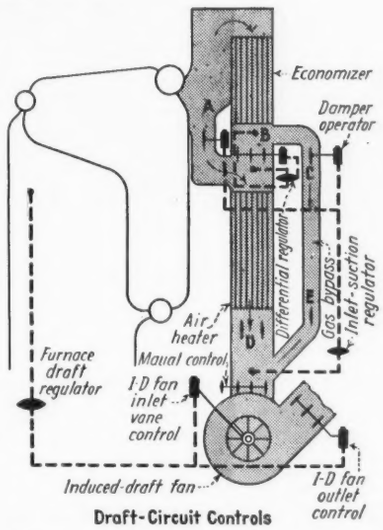
Biggest Boiler by RILEY

The 450,000 lbs. per hour Riley Steam Generating Unit recently installed by "Big Steel" is the largest steam generating unit installed in the iron and steel industry. The unit is fired primarily with blast furnace gas; however, to make up deficiencies in gas supply and to handle full boiler load if gas supply is cut off, a complete pulverized coal firing system is installed. With pulverizers turning over, only eight seconds are required to have pulverized coal system in operation.



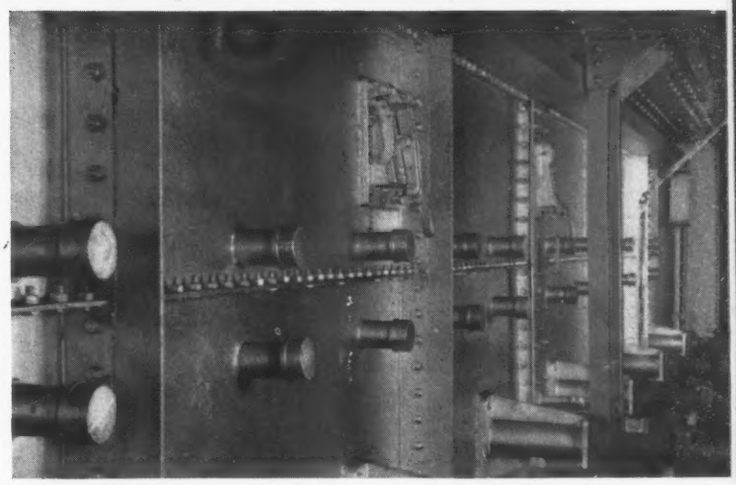
The load at this plant is characterized by swings of enormous range-load at times increasing 250,000 pounds per hour in a period of less than ten seconds. The above chart shows the load characteristic when 100 inch rolling stock constitutes major load.

The unit is equipped with economizer and air heater. Due to the fact that blast furnace gas is a waste product, when sufficient blast furnace gas is available to carry full loads, it is more economical to sacrifice efficiency and reduce fan power by reducing draft losses. Consequently, a system of ducts and dampers, making possible the flow of gases to economizer and air heater, in parallel when operating at full capacity with blast furnace gas and in series when carrying full load with pulverized coal alone, or various combinations with variations in proportions of these fuels. The quantities of gases passing in series and parallel is regulated by the combustion control, all gases passing in series until suction at induced draft fans reach a certain maximum. The above chart shows the draft circuits.

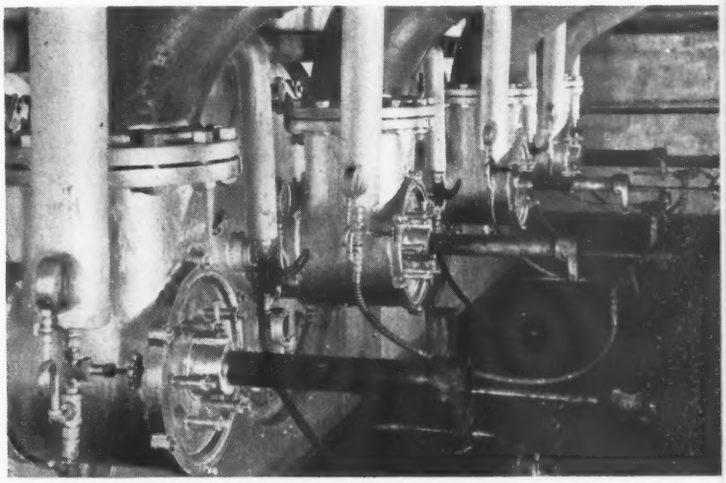


Draft-Circuit Controls

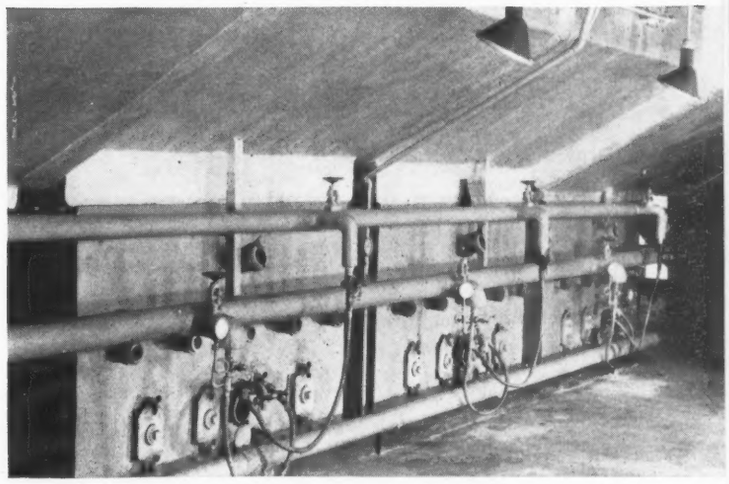
Reprints of an article which appeared in *Power* describing this installation in detail will gladly be sent you upon request



Front Casing at third elevation showing test connections and retractable gun type soot blowers



Pulverized Coal and Oil Burners are located at second elevation



Blast furnace gas burners are at the operating floor level

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

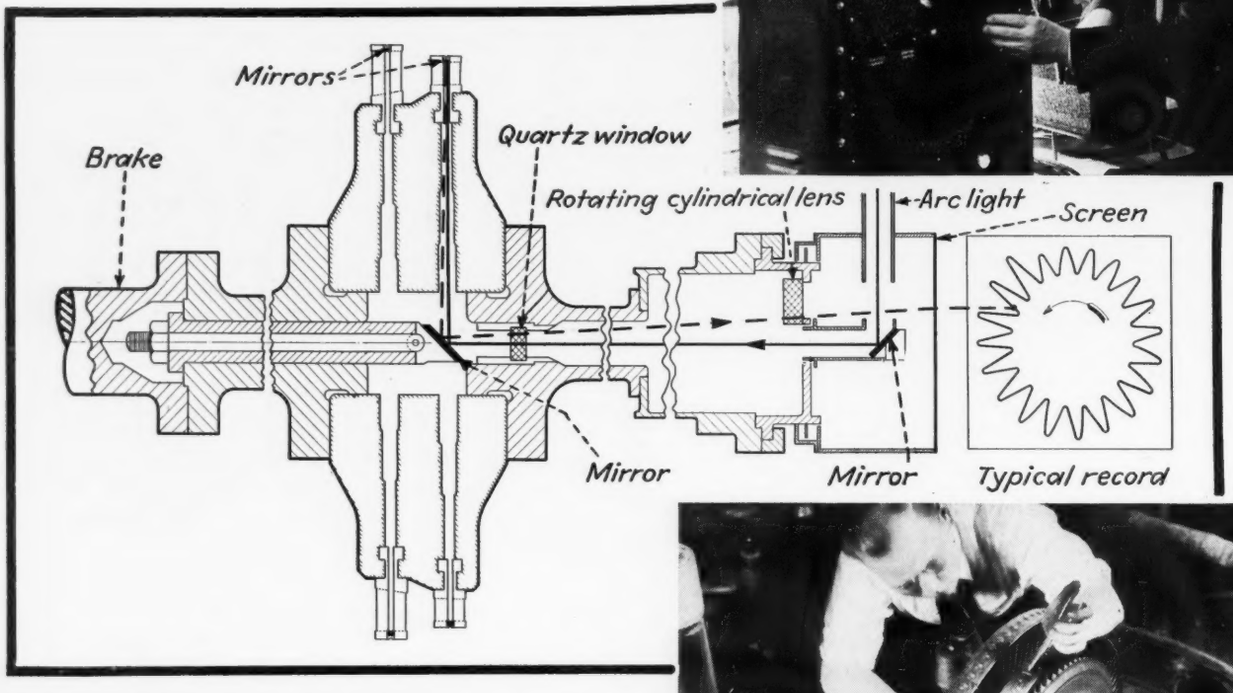
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

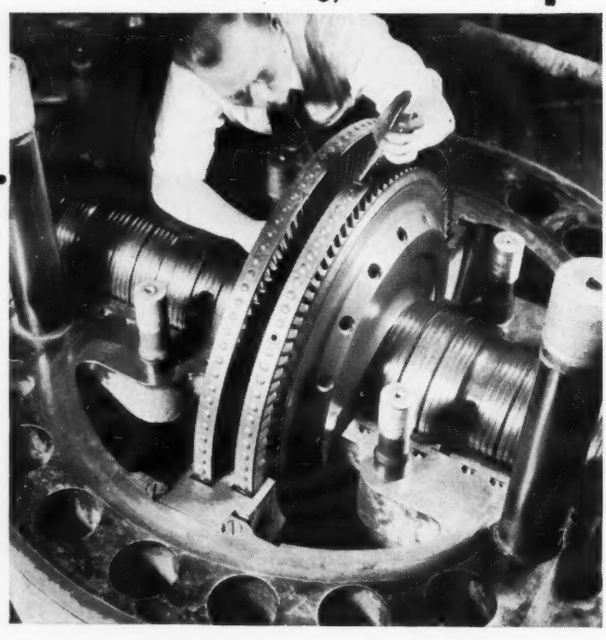
Streamlined—Inside and Out

(CONTINUED FROM PAGE 87)

Because governors now have increased importance to system stability and other related operations, several new special instruments analyze governor performance on an oscillograph. An ingenious valve-travel recorder accurately records as little as 0.05-inch movement or a sudden full opening of eight inches. Other instruments of this setup measure the several oil pressures of the control system fast enough to record variations in pressure lasting only one-sixtieth of a second



Much has been learned about blade resonance from this optical system installed in the hollow shaft of the turbine above. Mirrors and a light beam trace movement of the blade on a film. A typical record is shown at the right. Sufficient data have been accumulated to assure safe blade structures



Studies of resonant blade vibration led to building this high-pressure experimental turbine that can turn out 10,000 kw from the single wheel shown. Here a tiny mirror is being fitted into an impulse blade to reveal the character of vibrations under load

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

Converts HRT Boilers to Water Heaters

THE FOLLOWING DESCRIPTION and the drawings are based on condensed information and rough sketches supplied by L A Corwin, General Supt, Froedtert Grain and Malting Co, Milwaukee, Wis. He converted an old hrt boiler to a heat exchanger by welding return bends to the ends of boiler tubes in such a way that three layers of tubes formed three continuous "coils." Exhaust steam supplied to these "coils" heats water at 200 F. This, in turn, is mixed with cold service water to produce large quantities of 90-F water for process use.

Many plants throughout the United States have old inoperative hrt boilers easily convertible into low-pressure heat exchangers in this manner. Such exchangers could be used for cooling as well as for heating liquids by other hot liquids or vapor.

Fig. 1 shows how Mr Corwin applied the return bends to a single layer of boiler tubes to make a continuous steam coil. The general arrangement and connection of coils is shown in Fig. 2. Each coil is separately trapped.

Fig. 3 shows general hookup of this heat exchanger with other process equipment. Controls of admission of steam to system, and of hot and cold water to the mixing valve, are automatic, so the system requires no labor beyond a daily inspection.

It may be easier and quicker to make the smoke box at the front end steam-tight and to add a steam chest at the rear by welding on a ring and a flat cover plate, Fig. 4. Steam is introduced at either end; both ends should be trapped. A safety valve should be provided.

To avoid code complications and possible danger, flat unstayed heads should

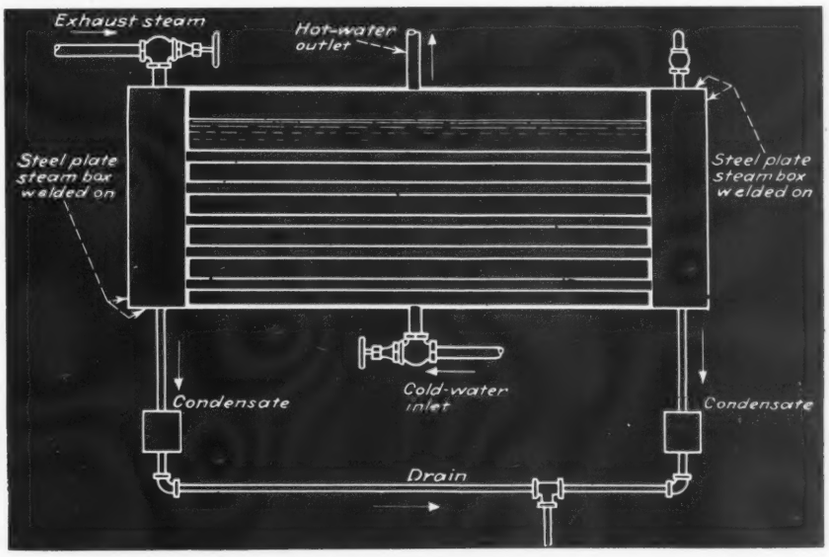


Fig. 4—Alternative suggestion may prove easier

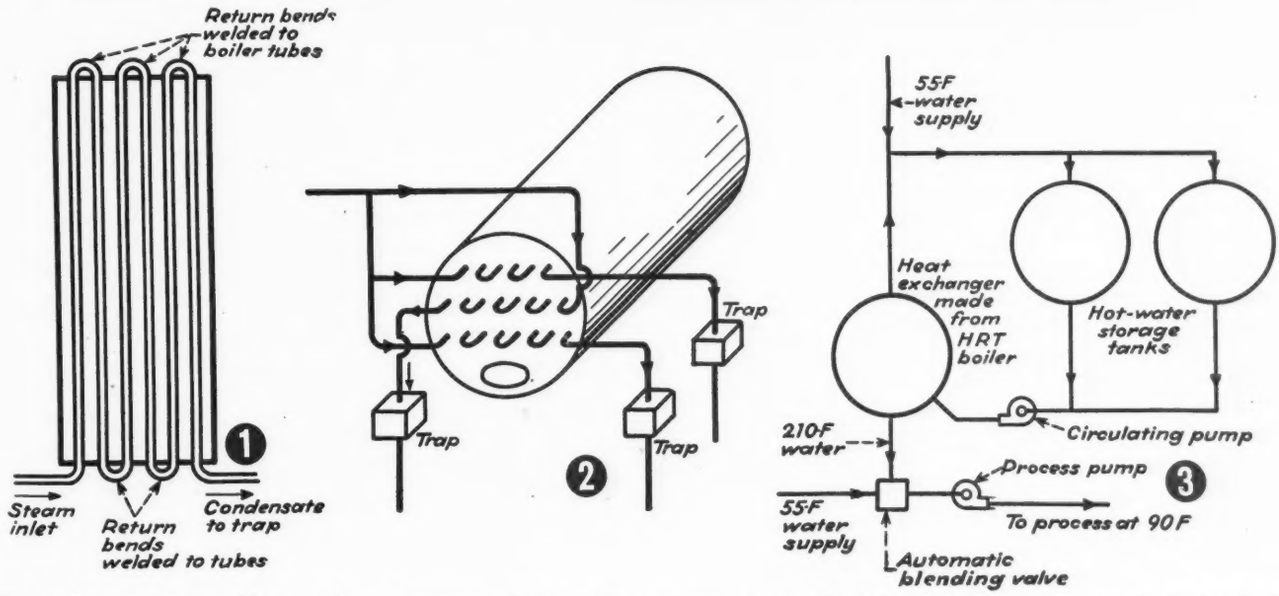


Fig. 1—Return bends welded to tube ends convert old hrt boiler into water heater. Each layer of tubes becomes a single "coil", as here shown. Fig. 2—Three layers are converted to individually trapped coils. Fig. 3—Heater, storage tanks, pumps and process-water blending valves

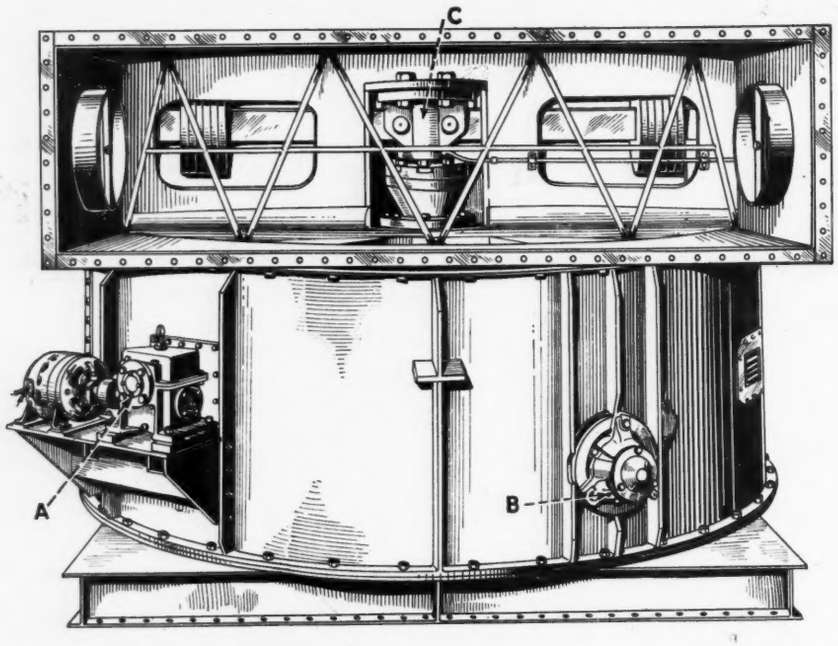


Fig. 1—Original preheater: A—Driving motor and reducer, B—Bearing bracket for one of three supporting rollers, C—Central suspension bracket on counter balanced levers

never be used for steam pressures much above atmospheric. Be sure safety valve has ample relieving capacity.

EDITOR

Salvaging Old Preheaters

BECAUSE STEEL IS A STRATEGIC war material, plant operators are being forced to give more and more attention to its conservation. POWER readers should therefore be interested in this story of the modernization of old air preheaters by the addition of steel parts weighing not more than 2% of the original units.

The two Ljungstrom (rotating regenerative) preheaters were originally installed in 1927 to serve two large boilers at Plant Atkinson, Georgia Power and Light Co.

The original arrangement was as shown in Fig. 1. Motor and reducer *A* turned the preheater rotor through a pinion meshing with a large belt gear surrounding the rotor. Most of the rotor weight was carried on three large rollers. The brackets supporting one of these rollers is shown at *B*, Fig. 1. Part of the weight was carried by central suspension bearing *C*, floating on the two counterbalanced lever arms.

From long years of wear the rotor track had become uneven and the leakage excessive. In the modern design of the air preheater (Fig. 2) both the circular track and the circumferential belt gear have been eliminated. Instead, the entire rotor is supported and turned from the upper end of a central shaft like that shown in Fig. 3. At the top of this shaft is the supporting ball bearing and bevel-gear drive. At the bottom is a "steady" bearing carrying no weight and permitting up and down motion as rotor expands and contracts.

The two old preheaters at Plant Atkinson were modernized by installing a central driving and supporting shaft of this type, removing the old gears, low drive motor, rollers and roll track.

At the same time the air and gas seals were renewed. Fig. 2 (*A* and *B*) shows the radial seal consisting of a malleable-iron wearing surface backed by a springy tube of alloy steel. The circumferential seal can be seen in *B*, Fig. 2. It is customary to replace the radial seal when the cells have been worn from the surface of the malleable iron blocks.

We had two objects in installing the central support and drive. One was to give Plant Atkinson the equivalent of new units at the lowest possible cost,

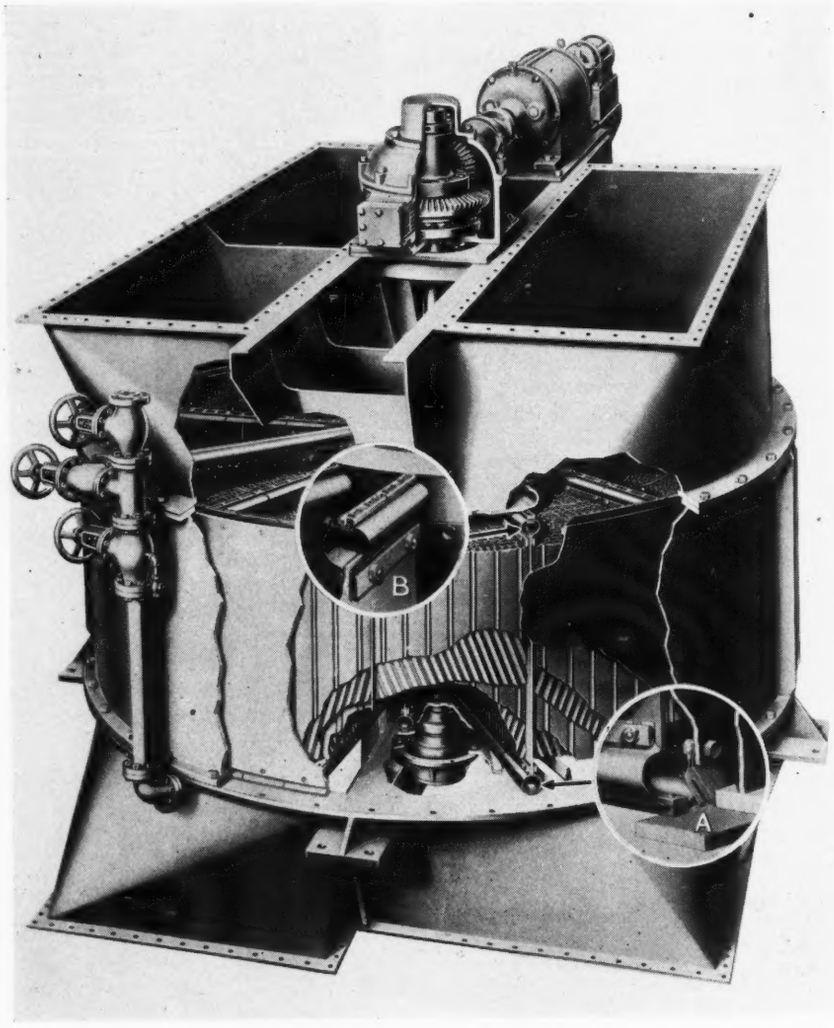


Fig. 2—Modern form of preheater with central support and drive. Old preheaters were modernized to approximately this form by removing rollers and gears and adding the central shaft and drive shown in Fig. 3

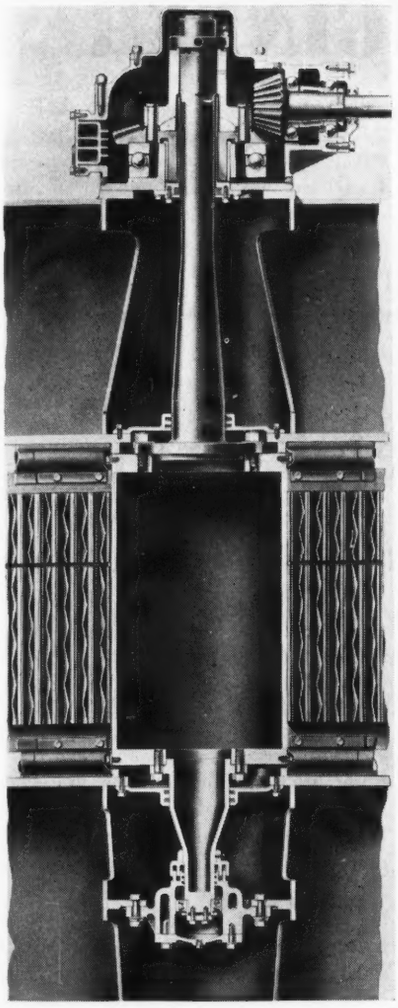


Fig 3—Drive shaft is supported and driven from top. Lower bearing is guide only

as soon as possible. The other was to cooperate with the Government in its present drive to eliminate all unnecessary demands on the steel mills—particularly for heavy plate and structural sections. The total weight of iron and steel used in modernizing these preheaters was not over 2% of their original weight.

New York, N. Y. J H SENGSTAKEN
Air Preheater Corp

You Can't Get These Valves

ONE OF THE LEADING industrial-power engineers of New England said POWER could reveal the following incident if we wouldn't identify anybody or anything. Recently, going through the pipe shop of one of his plants, he found row after row of unused bronze valves, ranging in size from 1½ to 3 in. More than a hundred of these had been gathering dust for years. The moral to other plant men is clear. If you are short of fittings or other equipment, search all the dark corners of the factory. You may find something extremely useful.

Connecticut FIELD EDITOR

Why Not Revamp Plant Junk?

ENGINEERS EVERYWHERE are acquiring a new respect for "junk"; war changes normal habits. Modern equipment is all right when you can get it, but the present inability of many plants to get deliveries on needed equipment places a premium on the ability of the man who can get by with what he can lay his hands on. In that connection I have a suggestion:

Every industrial plant has a pile of discarded valves and machine parts (reducing valves, relief valves, gears, pulleys, handwheels and so on)—equipment too good for the regular junk pile but not good enough for the stock room. In many cases these units are perfectly sound as far as their bodies are concerned; all they need is some machine work on the trimmings (such as valve disks) or the exchange of trim parts with other equipment.

Right now almost every town has its small jobbing machine shop that is working part time (or perhaps is closed up) because the owner hasn't any war contracts and therefore cannot buy materials. Why can't the local plant engineers get together with the owner of the machine shop and arrange for him to rebuild all the usable odds and ends of discarded equipment—particularly such items as valves. This revamped equipment could be sold back to the factories at a good profit. The shop owner would make money and also be performing an essential service in the war economy.

(Reader discussion of this proposal is invited, but talk it over first with your home-town plant engineers and machine-shop owners—EDITOR)

Waterbury, Conn. A J GERMAN
Chief Engineer, Scovill Mfg Co

Rebuilds Crane Motors in Three Hours

OUR ORGANIZATION HAS LONG PRACTICED preventive maintenance. I believe this policy has been largely responsible for our relative freedom from breakdown. The traveling cranes are a good example. These are in use almost continuously, yet are thoroughly maintained and give but little trouble.

Once every day the chief crane operator is required to ride each crane personally, operate all the controls and report any imperfections to the head electrician and head mechanic. He spots trouble before it happens. The maintenance crews have been trained to perform major operations on cranes with only slight interruptions to service. At first it took the crew a whole day to replace an armature and field coils. By practice that time has been cut to three hours. Part of the secret lies in stopping the crane directly under a roof truss for the convenient use of special slings and hoists.

Bridgeport, Conn. B G FORBES
Electrical Engineer
Bridgeport Brass Co

Tell Us Your Troubles

BY PHIL SWAIN

AS I POINTED OUT in the first instalment (February), this clinic is a troubleshooting department—a place to tell what went wrong in your plant or almost went wrong—because there's a war. We are talking about the kind of troubles that occur when plant equipment is overloaded, when it works around the clock with no chance for normal maintenance, about troubles caused by inability to get new power units, or even repair parts and supplies.

However, we can't stop with the troubles; we must know their cures. Tell what you did to avoid the trouble or cure it. In particular, show how you prevented shutdowns and how you made high-speed, emergency and unusual repairs.

Include sketches or photographs wherever necessary to make steps clear. All material published will be paid for at regular rates. Names and other identifications will be omitted on request, wherever their publication might be objectionable for reasons of national or personal policy.

These stories may come from industrial plants or central stations. They may refer to any kind of power-service equipment: boiler room, steam prime movers, diesels, hydro, pumps, compressors, refrigeration, etc.

THE OPERATING ENGINEER

George Edwards
Advisory Editor

Practical Aids
Maintenance Hints
Questions — Answers

Published monthly as an integral part of POWER

How to Inspect a Diesel Engine

Sound maintenance, more important than ever today, depends on thorough periodic inspection of engine condition and alignment. E. R. Spencer,* in this article and another to follow, outlines a practical step-by-step procedure for checking the principal moving parts of heavy-duty slow-speed engines

WITH TODAY'S LONG HOURS and heavy loads putting more and greater strains on industrial equipment and with maximum reliability absolutely necessary to insure continuous production, intelligent maintenance is more important than ever before. Thorough periodic inspection is the basis of intelligent maintenance; inspection reveals conditions that can be adjusted or corrected quickly and thus prevents costly and time-consuming breakdowns that inevitably follow neglect.

This article offers a proven procedure for making some of the more important inspections involved in the maintenance of heavy-duty slow-speed diesel engines so often found on main oil pipelines and in other severe industrial services. There are other ways to obtain the desired results, but this recommended procedure is based on a complete investigation of mechanical conditions and alignment. Nothing is taken for granted. Although repair methods are not considered, it is assumed that necessary steps will be taken when inspection reveals irregularities.

How often should such an inspection be made? Many factors affect the permissible elapsed running time. A few of the most important are: (1) load factor, (2) nature of fuel, (3) frequency of starting and stopping, (4) operating conditions, presence of dust, etc, (5) program of running repairs, and (6) effectiveness of lubrication.

* Engineer, The Cooper-Bessemer Corp, Mt Vernon, Ohio. Adapted from a paper presented at the Kansas City meeting of the Oil and Gas Power Division, ASME.

Naturally the only sound basis on which this period can be determined is past performance under a given set of conditions. However, under average conditions, these heavy-duty slow-speed engines can be kept in good condition by inspection and overhaul every 8000 to 10,000 hours of operation.

Assuming that the engine is ready for this periodic inspection, attention turns to the task of examining some of the major parts. After the engine has been dismantled and cleaned up, the alignment and condition of the crankshaft becomes the operator's first concern.

Check Bearing Condition

Remove each main bearing cap and check for such mechanical defects as loose babbitt, cracks and evidence of wear or other improper operation. In a similar way, inspect each lower shell as it is removed, replacing those required for shaft support. If any of these bearings shows need of repairs, it should be sent to the shop at once. This done, suspend the shaft on two lower bearing shells, locating them so the shaft will be balanced. Do this by trying to make the overhanging ends about equal and the sum of the overhangs as nearly equal to the distance between supports as is practical.

With the shaft suspended in this manner, inspect it thoroughly for defects, injuries, or wear. Perhaps the first step should be examination for cracks. The origin of cracks will usually be found in or near fillets, holes, or points of abrupt change in section. Paint all suspicious parts of the shaft with a mixture of chalk and alcohol. Rotate the painted shaft to allow any crack present to give up entrapped oil, which will discolor the chalk. If large, heavy shafts prove difficult to rotate, bump the shaft with a wooden ram to set up a vibration that will aid in liberating the oil. Needless to say, if cracks are found the shaft should be repaired.

Next examine each crankpin and journal for scores, rough spots and other evidence of undue wear. With calipers and micrometers, determine the amount of taper and out-of-round. Barring accidents, the wear on main journals is usually quite uniform. Sometimes inaccurate machining in older engines causes misalignment and tapered crankpins are often found. This is not serious if the taper is uniform and the bearing is fitted properly.

Flat spots do, however, become a real problem. A crankpin 0.0005-in. flat, per inch of diameter, will produce noticeable noise. The maximum flat or out-of-round allowable in any case depends on how important the operator considers the noise and the more rapid wear on the affected parts. Attention should be given to truing up the pin when the out-of-round wear becomes as much as 0.001 to 0.0015-in. per inch of shaft diameter. It may be necessary to move the shaft supports during this examination to permit inspection of all journals.

You are now ready to check the shaft for any indication of permanent deformation. This can be made much easier by using sufficient dial gages

to place one over each suspended journal. Fix them securely in position so that the operating points will rest on the respective journal tops.

Set all dial gages on zero and revolve the shaft slowly several times, watching for any appreciable deflection of the indicator hands. Then set the No. 1 crankpin on top center, reset all gages and again rotate the shaft slowly. Stop the shaft at each quarter position of No. 1 crankpin and read all the gages. If there is still no evidence of permanent deformation, rotate the shaft and take readings once more as a check.

If on the other hand the gage readings indicate a kink in the shaft, further investigation is required. With the aid of previous readings, rotate the shaft slowly to find the position of No. 1 crankpin which causes the affected gages to show maximum readings. This puts the deformation or bend in its extreme top or bottom position and the angle between No. 1 crankpin and top center can be measured with a protractor. Again reset all gages and rotate the shaft slowly as before, stopping the shaft to read the gages at 90, 180 and 270 degrees past the point where the bend is in the extreme top position. Repeat the same procedure until consistent readings are secured.

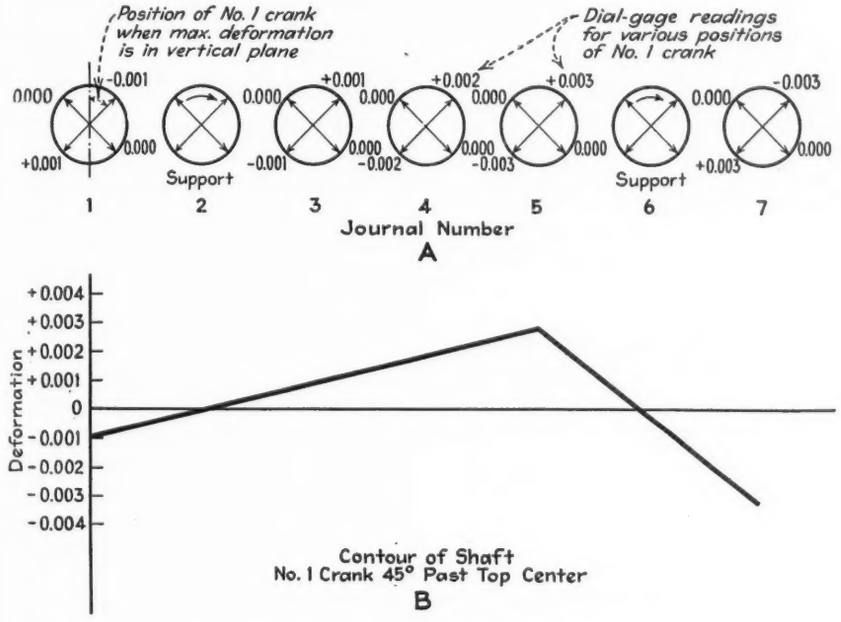


Fig. 1*A*—Method of recording dial-gage readings to check for shaft deformation. *B*—Plot of dial-gage readings which shows location and amount of deformation

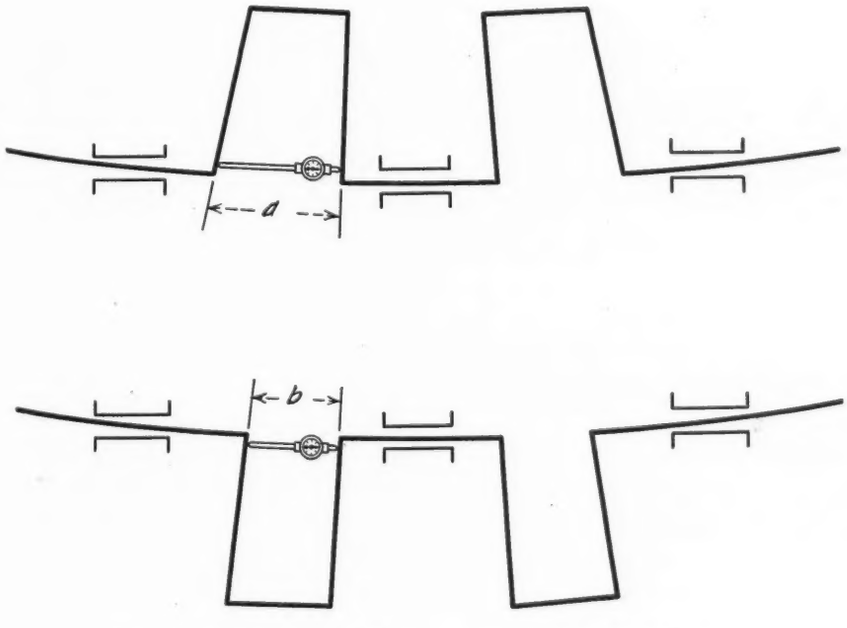


Fig. 2—Strain gages in position to measure crankweb deflection

Fig. 1*A* shows a system commonly used to record the readings intelligently. After drawing the circles to represent each journal, locate the position of No. 1 crankpin accurately on the circumference of each circle and put the reading next to it. This gives the position of the No. 1 crankpin (45 degrees past the center in this case), when the bend is in its extreme top or bottom position and the number on each circle at the 45-degree point is the reading from the dial gage at each journal.

Next mark a point on each circle 90 degrees past the first mark. Place alongside these marks the reading of the dial gage taken when the No. 1 crankpin is in this new position. Repeat this for the 180- and 270-degree positions. Remember that all dial-gage positions are taken from the same point and that the location of the readings on the circles indicates the position of the No. 1 crankpin when the particular readings were taken. One set of circles may be used for several trials although there is less chance of making errors if new circles are used for each set of measurements.

Locating Bend

In Fig. 1*A* the bend is in the extreme top position when the No. 1 crankpin is 45 degrees past top center. The readings taken along the shaft at this point can be plotted as shown in Fig. 1*B* which gives a graphic idea of the shape of the deformation and the location of the maximum deflection. Note that the 270-degree readings would give the same contour upside down, with the bend in the extreme bottom position, and that the readings 90 and 270 degrees past the first reading show no deflection, indicating that the shaft bends in only one plane. The horizontal scale on the chart in Fig. 1*B* represents distance between dial-gage positions, which should be measured accurately.

In special cases it may be desirable to change the location of one or both supporting shells and repeat the entire procedure as a check on the original investigation. Shafts with more complicated deformations than a simple bend can be investigated by the same method.

The amount of permissible deformation is subject to discussion. It is recommended, however, that steps be taken to straighten the shaft if it shows a deformation of more than 0.002 in. plus 0.0004 in. per inch of diameter.

Replace all the lower main bearing shells in the exact locations from which they were removed. When they are centrally located, block each shell in place so that the shaft can be rotated without shell movement. Lubricate each journal

so that a continuous oil film is secured.

The shaft is now ready for alignment. Bridge-gage readings and crankweb deflections should be made simultaneously or at least in conjunction with each other. If no bridge gage is available, spot the frame directly above the top of the journal. Measurements may then be taken from this permanent reference point to the top of the shaft with inside micrometers. For the purposes of this article it is assumed that a conventional bridge gage, Fig. 2, is used. Other instruments and equipment required for checking alignment include a strain gage and two jacks or clamps to hold the shaft down in the bearing shell.

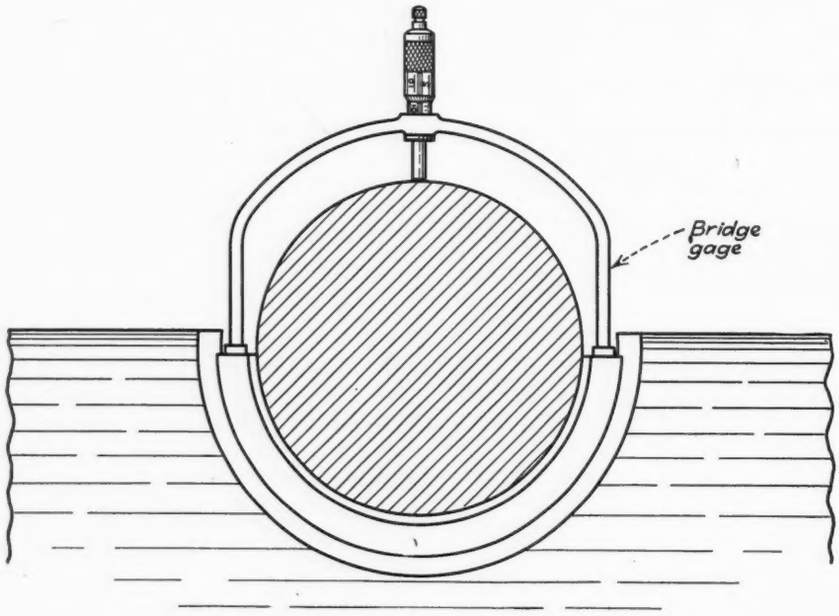


Fig. 3—How to place bridge gage to check shaft alignment

First place the No. 1 crankpin in its top center position and install the strain gage near the centerline through the main journals. Revolve the gage several times to make sure of accurate reading and then set the dial to zero. Before moving the shaft take a bridge-gage reading of the journal on either side of the crank throw in question. Rotate the shaft in the direction of normal operation. Stop the shaft at each quarter position and record strain- and bridge-gage readings. The bridge-gage readings on the four quarters serve as a check; the readings should be the same after allowing for the out-of-round values previously measured.

Repeat this procedure, using the jacks or clamps to press the shaft down to a solid bed in both main bearing shells (one on either side of the crank throw in question), when the crankpin is in its extreme top or bottom position. There should not be more than 0.002 in. difference in the bridge-gage readings of either journal when the shaft is free and when it is clamped. If a reading differs more than the prescribed 0.002 in., it may be assumed that the particular bearing involved is lower than the adjacent ones. Of course the bridge-gage readings will have little value in determining high bearings. These readings serve more as an aid to interpreting the strain-gage measurements than as independent indications.

Repeat this procedure with each crank throw. When this is done, use an approved shafting level and check the slope of each main journal and that of the adjacent main frame. The levels thus obtained not only indicate the shaft contour but are useful as an additional check on the strain-gage readings. If there is evidence of misalignment, the best plan is to make a sketch of the shaft showing levels and maximum deflections. A study of this sketch will indicate clearly the location of high or low bearings. From the information thus obtained, a skilled mechanic can scrape high bearings down to proper alignment. All high bearings must be lowered to the low bearing level or the low bearing must be raised by rebabbitting. Flat spots, taper, and out-of-round should always be kept in mind when interpreting crankshaft measurements.

Good practice indicates that crankweb deflections should be held below a maximum of 0.002 in. On first thought it may seem inconsistent to use a single value for all heavy-duty crankshafts. However, because short-stroke shafts are usually designed with thinner web sections, the actual variation of stress will be small with any given deflection. In any case, when the deflection is held to 0.002 in., or less, the fiber stress in the shaft will be far below the extreme limit stress prescribed by many insurance companies.

Main bearing inspection and adjustment are so closely related that both phases will be discusssed at this point, for the sake of clarity. If the previous inspection of these parts has revealed an uneven or poor bearing surface, blue the shaft and place the bearing cap in place with just enough shims to keep it from gripping the shaft to prevent turning. Pull down the bearing bolts evenly and with proper tension (never use a sledge); then rotate the shaft. This will indicate high spots on the bearing which can be relieved in an approved manner.

Adjusting Bearings

The above method of fitting main bearings will eliminate the possibility of scraping the bore of a bearing out of parallel with the shim surfaces. Do not set a bearing on top of a shaft as a means of determining its surface condition. If the bearing has been fitted properly, the adjustment will be simple. Add the proper amount of clearance to the shims used for the last bluing. Replace the caps and tighten bolts evenly and without undue strain.

If nothing more than adjustment of clearance is required, an easier method may be followed. Replace the original shims and place lead wires over the top half of the journal, the number of wires depending on the bearing length. Usually from two to four wires will suffice. The lead wire should be soft and the diameter not more than twice the normal clearance; 3-amp fuse wire serves the purpose well. With the wires in place, install the cap and tighten the bearing bolts. Remove the wires and determine the maximum thickness which, of course, represents existing clearance. Reduce shim thickness as required and reassemble the bearing.

Regardless of the method used to adjust clearance, rotate the shaft after setting each bearing. The fitted and adjusted bearing caps should not add any appreciable drag on the shaft. The usual clearance allowed on main bearings is 0.0005 in. per inch of shaft diameter, plus 0.002 in.

With shaft and bearings properly adjusted and passing all inspection, the shaft should roll freely and give another 10,000 hr of troublefree operation.

In the next article E R Spencer will outline the procedure for inspecting cylinder liners, crankpin bearings, connecting rods, piston pins and bearings.

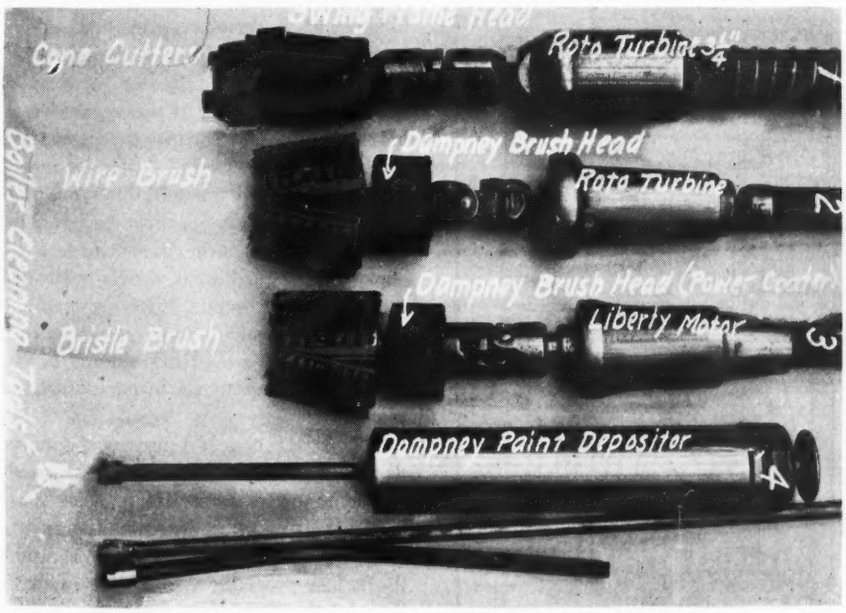
HOW ONE PLANT CLEANS BOILERS

Extracts from Dan Gutleben's famous "log" show how he puts a boiler in first-class shape. The exact procedure necessarily varies from plant to plant; we print these notes because they reveal principles important to every operator: (1) know the job to be done and the tools needed to do it, (2) know the job cost and record it for comparison, and (3) know what results the job produced and whether the cost was justified

▶ NO TUBE OR AIR-HEATER cleaning had been done for a year. The water tubes had a small amount of scale that did not respond to the brush, so every tube was cleaned with cutters, followed by the brushes (one pass of each). Air-heater tubes were cleaned the same way; superheater tubes required no cleaning. All tube and drum surfaces in the boilers and economizers were painted with Apexior according to annual custom.

Draft-fan bearings were cleaned and filled with fresh oil. Turbine gears were dismantled, inspected and given a fresh supply of oil. No repairs were necessary. The non-return and the two feed valves on No. 2 boiler were reground. The furnaces required some repairs but the chemical-brick stack lining was in perfect condition. The coal bunkers were cleaned of rust and given two coats of Rockalyte, brushed on. The accumulator was drained to permit valve packing and everything was found in good order. Both feed tanks were inspected and found to contain a small amount of deposit in the bottom and an oily high-water mark at the top.

Foreman Eckstein and 15 men spent five days on each boiler for cleaning, one day for Apexiorizing and two days for furnace repairs. The bricklayer worked five days in each furnace and the painter foreman and five men worked 16 days on the bins. The job started with boiler No. 2 on December 2 and finished with No. 1 on December 23. While one boiler was out for cleaning, the other, together with the old 150-lb boilers, made the steam for plant operation. During the cleaning period, the high-pressure boilers produced 40,000 M lb at 16.75 cents per M for fuel, while the old units produced 24,800 M lb at 23 cents per M lb. The difference of 6.25 cents per M lb represents a total for the cleaning period of $1550.



Here are the tools for the boiler cleaning and painting job, as pictured in the "log"

The improvement in efficiency produced by internal boiler cleaning was not sufficient to be noticeable but the air-heater cleaning reduced the stack-gas temperature about 50 F, which makes a saving of 50 lb of coal per ton in favor of the clean boiler.

The tools required are illustrated in the photograph and are used in the order shown. To facilitate use of these tools, air and electric connections are provided opposite each manhole. Two portable 3000-cfm exhaust fans furnish fresh air, one being connected to the lower economizer drum and the other to the lower boiler drum.

The importance of a liberal supply of good tools is emphasized by the fact that the annual week's outage of each boiler costs about $800, even though the job is done at a time when the rate of operations is reduced. At the conclusion of the annual cleaning job, all of the turbines are cleaned and laid away in an oil-filled box.

Our Roto turbine (No. 1 in the photo) has a free speed of about 18,000 rpm when supplied with air at 90 lb, and consumes about 80 lb of free air per min. The braking action of the load reduces the speed to somewhere between 1000 rpm with 58 cfm air consumption and 3500 rpm with 63 cfm. The probable speed in our tubes is between 2500 and 3500 rpm.

One man operates a machine and plays out the hose till his ears and the feel tell him the cutters are about to leave the bottom of the tube. Then he pulls the hose back, and when it reaches the top he kinks the universal joint to slow down the head so that he can grab and insert it quickly into

the next tube. (Roto makes an operating valve to take the place of kinking as a means of stopping the machine; we shall try it on our next job). Three men are assigned to two machines so as to assure continuous operation of the cleaners and to give each man a third of an hour breathing spell.

By the clock, one machine traveled through 137 straight waterwall tubes, aggregating 4767 lineal ft, in 24 hours. The average rate of cleaning was therefore 200 ft per hr or one 35-ft tube in 10½ minutes. The sharp curves reduce the speed. The head shown as No. 2 in the photo was made smaller and provided with a universal joint at the hose connection to facilitate travel around sharp curves.

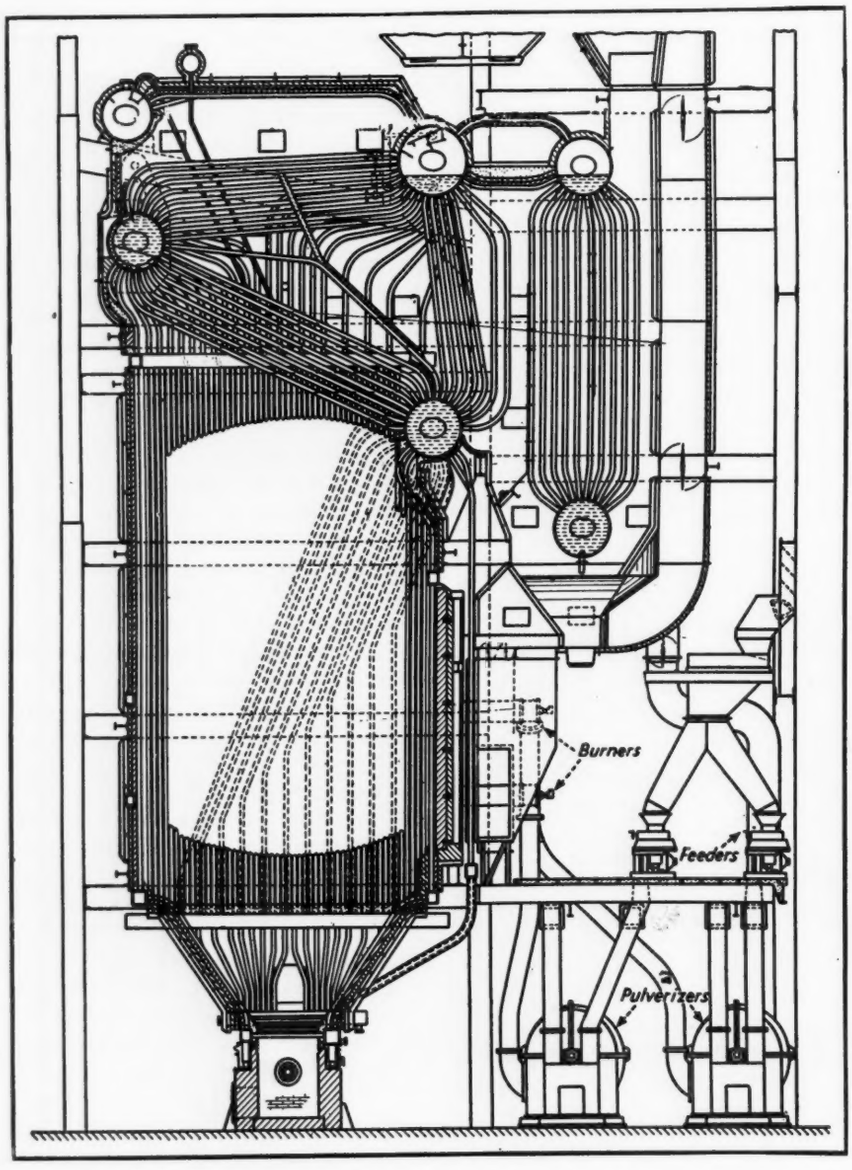
To clean 103,000 lineal ft of boiler and air heater tubes required 50 sets of cone cutters and 40 sets of wire brushes. Extra heads are on hand fitted with brushes or cutters so that replacement is accomplished in a couple of minutes. As soon as a tool shows signs of distress it is taken to the machine shop and another is attached in its place.

Our Liberty motor is more satisfactory for painting because of its slower speed. The free speed is between 6500 and 7000 rpm and the air consumption is the same as the others. Three men are required for the operating squad. Two men in the upper drum operate, respectively, the paint measuring gun (No. 4 in the photo) and the brush, while the third man is stationed in the lower drum. The man at the bottom holds a funnel under the respective tube to drain the surplus paint into a bucket. He hollers warning to the man above in case the brush threatens to overtravel. When these brushes leave the tube and assume their free speed, they fly apart and are destroyed.

If the operator in the lower drum does not catch at least a spoonful of surplus paint, he knows that there are "holidays" in the coating and he signals for another dose. The funnel prevents spreading surplus paint over the drum surface but whatever smearing takes place is promptly wiped off to avoid building up heavy masses of paint. The rubber collars on No. 2 and 3 in the photo are made of pieces of hose 2⅜ in. OD x 1½ in. ID, cut to length on the job. Four "Libertys" with paint brushes traveled through 27,235 ft of boiler tubes in 24 hours, or about 300 ft per hr per machine. To do 52,000 lineal ft of boiler tubes required 20 sets of brushes, about 2 brushes per mile. Extra heads fitted with brushes were kept at hand for quick changing, as with the cutters.

The paint depositor (No. 4 in the photo) measures the Apexior according to the length of the tube. Various nozzles are provided to shoot the paint over the hump in case of tubes that have a downward turn at the top. The bristle brush follows promptly after the paint is deposited.

Total cost for boiler cleaning and painting, furnace repairs, fan, turbine and valve maintenance, and painting coal bins was $5,001, plus $1,550 to cover higher cost of steam during outage period. Total man hours for the job came to 4,544.



Two 350,000-lb-per-hr units like this were cleaned in just under 3 weeks

✦ ✦ ✦

Soldered Joints

There have been reported several accidents of a serious nature involving steam pressure vessels with soldered joints. Unless such seams are adequately strengthened by means of rivets or other sufficient means, these vessels are obviously unsafe, because most solder, at 212 F, has negligible strength, and all of the stresses must be carried by some other form of construction. The failure of soldered vessels, such as tanks, range boilers, sterilizers, etc, with subsequent damage to property and injury to attendants should be a definite warning to all owners of such vessels.

The ASME code for pressure vessels does not mention ordinary solder, nor are soldered joints satisfactory for vessels constructed under the Code. In ordering new vessels for pressure uses the safest procedure is to specify that they be constructed in accordance with the ASME code.—*The Locomotive.*

ARGUMENT CORNER

Insert Safety Link in Pulling Medium

IN THE QUESTION on pulling cable in the Dec. issue RLZ should visit the job and see that the ends of all sections of conduit are well reamed and that there is a minimum of short bends. Where sharp bends are unavoidable, as is often the case, the sections of conduit for these bends should be filled with sand before bending. The sand will prevent the conduit flattening on a short-radius bend. After bending, the sand may be easily removed by probing with a wire or by tapping with a hammer.

Actual pulling of the cable starts by sending through the messenger, either direct or reverse to or from the first pull box. Where the messenger is to be used as a drawing cable, it is usually sent through in reverse. In this case the conducting cable is invariably small. For larger conductors a drawing cable must be used. The messenger is then sent through direct, fished out at the first pull box and fastened to the draw cable. The draw cable is then pulled through in reverse, and the conducting cable fastened to it by looping and wrapping the ends. Clamps are difficult to use as they tend to catch at the couplings.

Where cable is drawn by hand, as is usually the case with smaller cables, the strength of the cable and its yield point may be closely determined by any experienced man simply by the feel of it. In the case of heavy cable, where a winch, block and tackle or even a simple reversing sheave is used, some means of ascertaining the yield point of the conductor must be applied. A simple way to keep from breaking a conducting cable is to test a short piece of it to destruction by fastening it to a beam or other support and hanging weights on it. Then use a draw cable which will break at a slightly lesser tension than the yield point of the conductor. The whole of the draw cable need not be this weak, although the section near the end of the conductor should be. This is a certain way to prevent stretching or breaking of the conductor, which is usually of much greater value than the messenger or wire rope used to draw. Check on stretch may be kept by measuring to make sure that as much conductor is going into the conduit as there is draw cable being pulled out of it. To do this, tie strings around both at regular distances, and check from these points.

Except for asbestos covered cable for use under high temperatures, it is hardly likely that the insulation will fail under slight stretch. However, it is certain that the circular mil area of the copper or aluminum will be reduced, and its safe ampere load diminished. This is especially dangerous, for even though the distance between the anchor point and the point the force in tension is applied may be a hundred feet, yield may take place only along a short section of the cable. At this point the conductor may heat and cause insulation failure.

Menard, Ill. GEORGE HOLMAN

Welding Heads in Vertical Tubular Boilers

REFERRING TO THE NOVEMBER issue of POWER, may I call attention to an article on page 111 with reference to the tube sheet of a vertical tubular boiler indicating a supposed approved type of inserting a tube sheet by welding, Fig. 1. On page 5, Paragraph 24, in the "Rules for Repair By Fusion Welding to Power Boilers and Unfired Pressure Vessels," as adopted by the National Board of Boiler and Pressure-Vessel Inspectors, March 6th, 1941, it states that this type of repair requires that the tube sheet to be installed shall be larger than the opening in question and shall be inserted through slots and drawn up against the flange of the vessel and then welded for tightness and security, Fig. 2. Therefore the welded job described by Mr. Wiggins does not meet code requirements for a strength weld.

This requirement has been effective in several states for a number of years prior to adoption by the National Board of Boiler and Pressure Vessel Inspectors and it would seem to me that Mr. Wiggins, coming from the State of Ohio should have been conversant with it. In order that others may not be misled and make repairs in a similar manner necessitating their rejection, I am calling attention to the requirements for doing such welding.

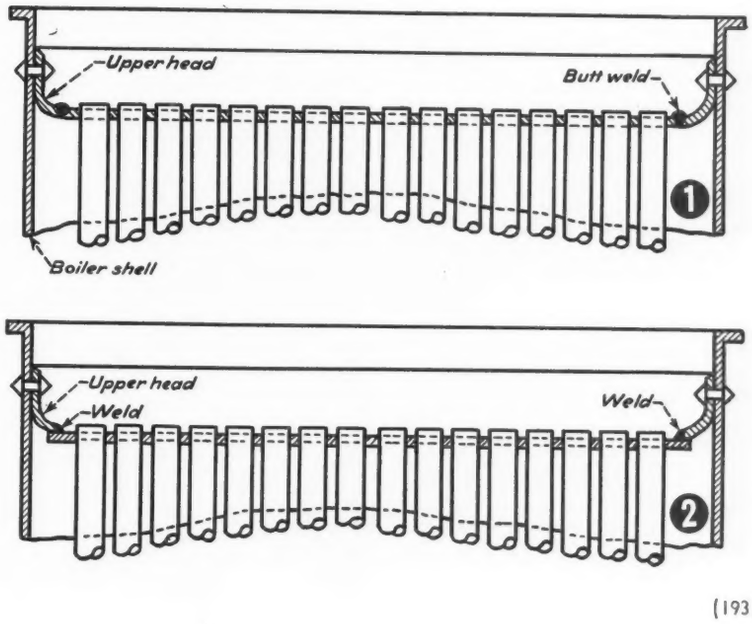
Pittsburgh, Pa. THOMAS ROGERS

On This and That

COMMENDATIONS ARE CERTAINLY DUE for the December issue containing "Handbook of Feedwater Treatment". As I am definitely a non-chemist, I have received more assistance in understanding a complex subject by your presentation in the Handbook, than I was able to obtain in fifteen years of groping through technical papers, text books and bulletins.

However, I would like to take issue with some of the implications of article No. 13 of the "Old Chief" in the same issue. That the boiler exploded when the engine throttle was closed was

(*Continued on page* 132)



READERS' PROBLEMS

Questions from Our Readers

What About Bomb Protection?

Question 1

A number of industrial plants on the Atlantic and Pacific coasts have asked POWER *how best to protect their power facilities against bombing. With no actual experience under fire, American power engineers must apply the lessons to be gleaned from British data with a common-sense realization of the difference in conditions here and abroad.*

Undoubtedly some engineers and plants have given this matter serious consideration, both from the angle of reducing damage from bomb hits and repairing damage and restoring vital services quickly. POWER *readers are invited to submit suggestions and sketches along these lines, particularly where the ideas involved have been put into practice in the form of building and equipment protection and staff reorganization for emergency action.*—EDITOR.

Diesel Waste Heat

Question 2

We have a 400-hp diesel engine that operates on loads varying from 150 to 400 hp, with a load factor of about 30% (for a 24-hr day). We now heat hot water for general plant use from 60 to 140 F in a separate boiler. Peak hot-water consumption is 1000 gal per hr and the total water use in a 24-hr day is 8000 gal. At present, the diesel jacket water is cooled in an atmospheric cooling tower. Can we use the engine jacket heat to supply this hot water and what piping and control hookup will take care of the water requirements and maintain the proper conditions in the engine jackets?—FWE

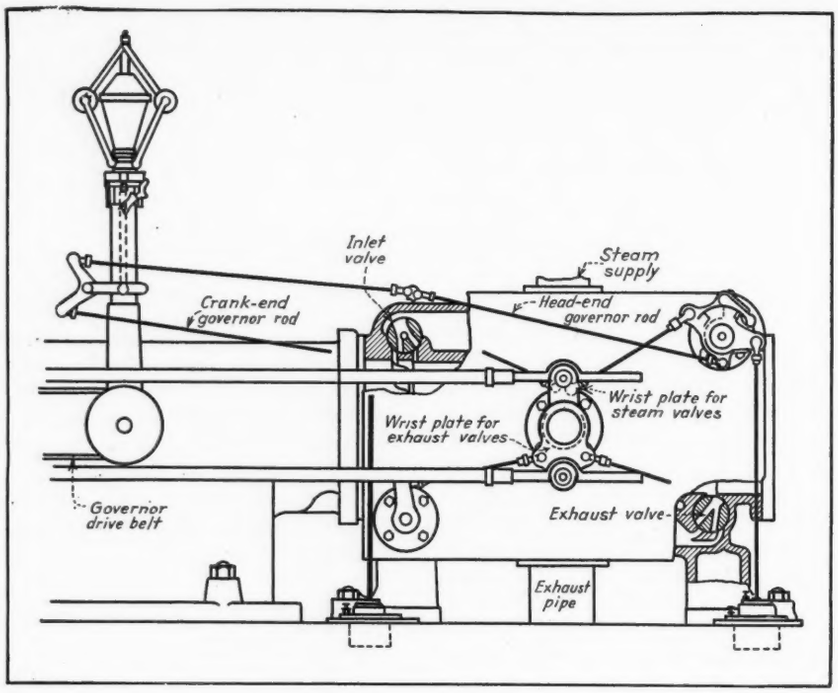
SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers accompanied by practical drawings or photographs will command additional pay.

Engine Will Not Release

Answers to Jan Question 1

The Question

WE HAVE A 14x30x42-IN., 98-RPM, *170-lb, Hewes & Phillips cross-compound double-eccentric engine which at times carries a load of 640 hp. When setting the valves on this engine the cutoff must be set shorter on the crank end than on the head end, or the crank end will not release during heavy loads. What is the reason for this and how can we correct it?*—WHS



Check Piston Clearance

IN WHS'S PROBLEM, the trouble seems to be insufficient piston clearance on the crank end, possibly caused by the piston not being centered in the cylinder. Of course, allowance must be made for displacement of steam by the piston rod on the crank end.

Another factor to be considered is that this engine is operating at maximum capacity. When developing 640 hp, therefore, the point of cutoff is set very late. Under these conditions, it is absolutely essential that the piston clearance be exactly the same on both crank and head ends.

Indicator card readings would show the trouble more easily than any other method.

New York, N. Y. T E MURRAY

Cutoff Latches May be Worn

THE CUTOFF IN WHS'S ENGINE is obtained by means of latch which is fitted with a fibre block that is pressed against the cutoff cam by gravity and a light spring. When the fibre block is on the lower portion of cam, steel dogs are engaged for steam-valve operation; when this fibre block is on the high part of cam, the steel dogs are released for cutoff. The cam position is controlled by the engine gover-

The crank-end steam valve does not nor, through reach rods.
release at heavy load, or, in other words, is out of control of the engine governor, because either the fibre block is worn, or shoulders have been worn on the governor-operated cam. By making the cutoff shorter on the crank end the latch is brought higher on the cam to compensate for wear of the fibre block. I would recommend that WHS check cam and latch-block wear, and order new fibre blocks and possibly new governor knockoff cams from the engine builder.

The governor cam rods should be readjusted after they receive new blocks or cams. This is done by placing the governor on the start pin, unhooking the reach rod from the wristplate, and turning the wristplate so that its centerline stands in line with one of the extreme lines on the wristplate stand-hub. The corresponding steam valve should now be wide open. Adjust length of the corresponding governor rod so that the dogs are almost ready to separate for this governor position. The wristplate is then moved to its other extreme position and the same procedure is carried out. The governor is then raised approximately $\frac{1}{4}$ in. off the starting pin by inserting a piece of key stock under governor crossarm. At this

point both steam valves should be released as the wristplate is rocked between its extreme positions. Raise the governor to mid-travel and block it at this point, hook up the reach rod to the wristplate, turn the engine over slowly, and when the steam valve has released, measure distance the crosshead has moved from its extreme position. Continue to turn the engine until the other steam valve has released, measure the distance through which the crosshead has traveled from the other extreme position. If governor rods are properly set, the two distances will be equal, and cutoff is equalized. If not, the cam rods should be adjusted until both valves are released at equal distances from beginning of stroke. After the adjustments have been found correct the governor should be raised to highest and lowest positions to check safety knockoff. The steam valves should not pick up when governor balls are in their highest or lowest positions.

Cambridge, Mass. FRANK HAWORTH

Check Valve Adjustments

THE TROUBLE OUTLINED in WHS's question concerning the cutoffs of a corliss engine is not unusual, particularly with the governor-rod arrangement shown in the sketch accompanying the question.

Assuming that the valves have been properly set, with the exception of the cutoff points, the cause for the failure of the crank-end valve to trip is the distorted movement of the knockoff cams with respect to each other, caused by the governor-rod angularity. From the wording of the question and the sketch it would appear that in adjusting for cutoff the governor was blocked in its mid position with the governor lever horizontal, and as a result of the angularity of the rods, any movement of the governor arm will cause the crank-end knockoff cam to move through a larger arc than the head-end cam. At late cutoffs the head-end cam stays within the range of travel of its knockoff lever and cutoff is effected, but the crank-end cam has moved beyond the travel of its knockoff lever, and if the two do not make contact, the valve will not be tripped.

The attached diagram shows a governor-rod arrangement with the movement greatly exaggerated for the purpose of illustration; note that with the governor in mid position, and cutoffs equalized with cams in position 2, the full range of travel from position 1 to 3 will be 35 deg on the head-end cam but 48 deg for the crank-end cam. Thus if the knockoff levers have a maximum travel of say 40 or 45 degrees, the head-end knockoff lever will contact the cam and trip the valve, but the crank-end lever will not travel far enough to strike the cam and cause cutoff to occur.

To correct the unequal cutoffs caused by the angularity of the governor rods is largely a matter of trial and error adjustments; one method would be to lay out everything to a large scale on a drafting board and obtain the correct rod lengths. If the head-end cutoff is satisfactory for heavy loads I would block the governor so that the head-end cam was in position 3, as shown on the diagram, clamp the cam collar in that position, and disconnect the governor side rod. With the crosshead at the same fraction of the crank-end stroke for which cam-position 3 gives cutoff at the head end, and with crank-end valve hooked up, shorten the rod HE1 and lengthen rod CE1 until the cam meets the lever and the valve trips. These directions may seem queer, but the object is to position the governor arms so that with the same previous movement the left hand end of rod CE1 will move through more of a vertical arc, resulting in the right-hand end moving through a lessened horizontal arc, and keeping the head-end rod HE2 unchanged.

Several adjustments may be necessary before one is obtained that appears to be satisfactory; the vertical governor rod should then be lengthened and re-connected to the governor lever. The governor blocking should then be removed, and the clamp removed from the head-end cam. The setting should be checked with an indicator and any slight necessary changes made by adjusting the lengths of rod CR1 and HE2.

The engine speed should not have been affected appreciably, as the governor will rotate in the same plane as before, for the head-end cutoffs. The changes at the crank end may cause some slight change but may be corrected by shifting the weight on the governor lever. The high and low safety should not have been disturbed by these adjustments but it should be checked as a precautionary measure.

Melrose, Mass. ELLIOTT MACDERMOD

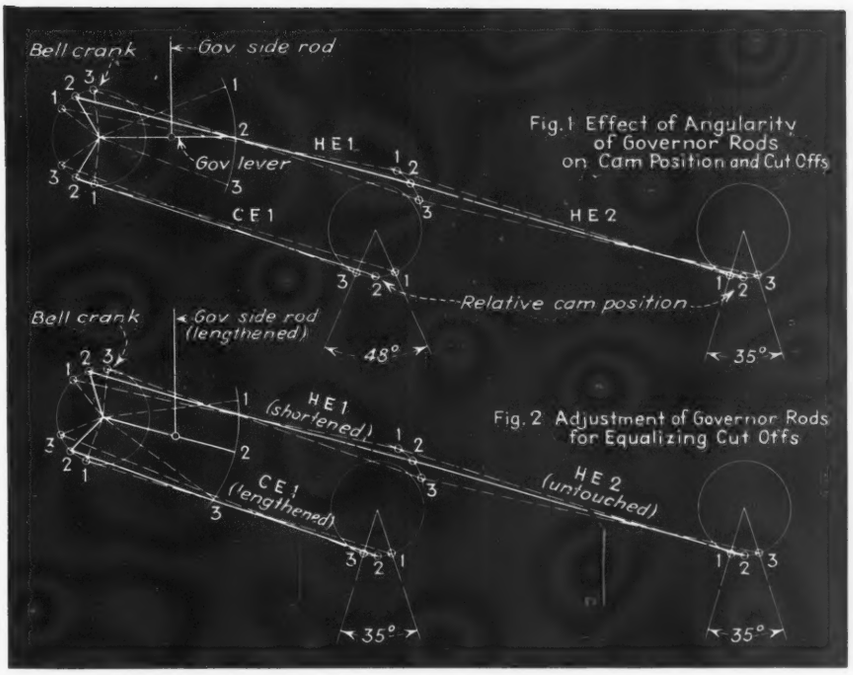


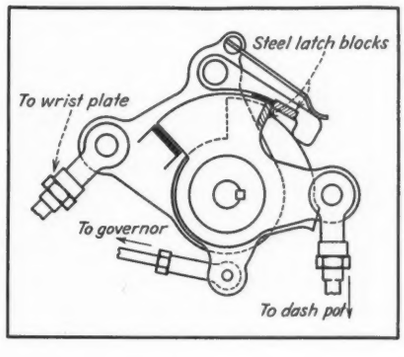
Fig. 1 Effect of Angularity of Governor Rods on Cam Position and Cut Offs

Fig. 2 Adjustment of Governor Rods for Equalizing Cut Offs

Wear and Lost Motion

WHS DOES NOT SPECIFY whether the trouble is occurring on the high- or low-pressure cylinders. However I think that lost motion from excessive wear in the valve gear is responsible for the valve not releasing. In opening the steam valve the required amount to carry the load, the valve arm deflects the stem and valve hook enough so that the latter does not quite engage the knockoff cam and consequently does not release. Rebushing the valve gear would overcome this trouble. I would also suggest that WHS check the length of the governor drop rod to determine that the governor bell crank oscillates equal distances from center for the high and low positions of the governor. Setting the catch plate back so that it does not have such a broad bearing on the pickup block might help until the valve gear can be rebushed.

Duluth, Minn. E R WEBBER



Change Governor Rod Adjustment

THE REASON WHS HAS TO SET the cutoff shorter on the crank end than on the head end, assuming his drawing shows the governor in the standing position, is that as the fly-balls lift, the crank-end governor rod moves faster and farther than the head-end rod. This in turn gives a wider range of cutoff on the crank end because the trip cam moves through a wider arc, and leads to early cutoff at light load and later cutoff at heavy load. It would seem

that this setting is correct since the volume of the crank end of the cylinder is less than that of the head end; the crank-end cutoff should be a little longer, to balance the work on both sides of the piston at heavy rather than at light load.

But if WHS thinks the difference is too great and wants to reduce it, he may be able to adjust it to his liking if both halves of the head-end governor rod are provided with right- and left-hand threads. Lengthening the left and shortening the right half equally will tilt the rocker arm, to which they are both attached, toward the head-end inlet valve. This will cause its outer end to move up and down more than it does now, as it swings back and forth with the rise or fall of the flyballs. The head-end trip cam will move through a wider arc and give greater cutoff range here also. If he has room enough for adjustment and has right and left threads on each half he can make the adjustment as he likes. If one half has only right-hand threads its length can be varied only half a thread at a time but even that may give a final adjustment that will be close enough for all practical purposes.

If the two trip-cam plates move through equal arcs at the same time, other things being equal, the corresponding cutoffs should be equal. This would improve the appearance of the indicator cards and perhaps engine operation.

San Diego, Calif. C A LeQuesne

What Causes Excessive Brush Wear?

Answers to Jan Question 2

The Question

WE HAVE A 5-HP, 230-V, 3400-RPM DC MOTOR *driving a centrifugal pump which delivers water against a 60-lb head with a 20-lb suction pressure. This motor has four brush-holder arms. We find it impossible to secure a reasonable life from the brushes on two of the arms, located opposite each other. The brush life on these two arms is less than half the life of the remaining brushes. Can* POWER *readers offer any suggestions to remedy this?*—SHP

Circulating Current

NUMEROUS CONDITIONS AFFECT the life of brushes on dc motors, but what SHP is concerned about is probably caused by the brushes being unevenly spaced around the commutator. What is more likely, the two short-lived brushes probably are not exactly opposite each other and are overloaded by current that circulates from one to the other through the jumper which connects them.

These two brushes constitute one pole of the armature circuit and thus are of the same polarity. That is, both are either positive or negative. If they are opposite but off the neutral point they should spark more than the other two and will have a shorter life. But if they are not exactly opposite each other a difference of potential exists between them which would cause the circulating current to flow.

Normal full-load current for this motor should be about 20 amp or 10 amp per brush. Now suppose, for instance, that there is a difference of potential of only one volt between them and the resistance of the circuit through them and the jumper, and the armature winding is 0.02 ohm. Then there would be 50 amp circulating around this local path. It would go in one brush and come out the other while the normal current would either go in or out both in parallel. The current in one brush would therefore be 40 amp and 60 amp in the other, which would shorten its life considerably. SHP could measure the drop in each jumper while the motor is running. In making these measurements clean solid contact is necessary or the readings will be unreliable. If there is much difference, the high reading will probably be across the two short-lived brushes and would indicate the circulating current that is destroying them. A rough test could be made by feeling the two jumpers.

The remedy is obvious. True up the commutator, undercut the mica and reset the brushes so they contact the commutator at points equidistant around its circumference.

However, check up on the bearings first. There is not much to be gained by resetting the brushes if the bearings are worn so the air gaps between the armature and the four polepieces are not all the same. And a little difference in the air gaps makes more than a little difference in the commutation.

San Diego, Calif. C A LeQuesne

Bent Brush Holder May Be the Cause

IF SHP FINDS IT IMPOSSIBLE to get a reasonable length of life from two of the four brushes in the motor, he should inspect the arms for uniformity in length and width and also see that none are bent out of shape, as a bent brush holder will do much to shorten brush life.

Renew the four springs at once; this should give equal tension on the springs if all are bought from a reliable manufacturer. Then the brushes should be examined to make sure they are the proper kind.

SHP doesn't mention the brush he uses, but in any case additional wear on brushes is caused by small particles of material carried by the current from the brush surface and deposited on commutator bars. He should get all the information possible from the motor manufacturer as to the proper brush for his motor.

To lengthen brush life under this condition without renewing all brushes, interchange them from each polarity. In this case I believe poor brush contact is the source of the trouble; if it isn't, then it's a case of a process of elimination. Start from the beginning, check and eliminate each possible cause.

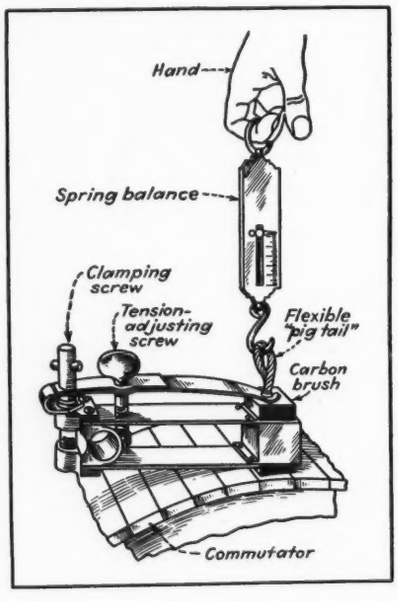
Philadelphia, Pa. T F Cunningham

Brush Material Important

THE FOLLOWING ARE SOME of the logical reasons and frequent causes for this action.

1. The four sets of brushes used on this motor may not be constructed of the same grade of material.
2. The brushes which wear down faster may have improper angularity or may be fitted loosely in the brush holders.
3. The pressure may not be equal on all brushes, or the pressure on the faulty brushes is either too great or too little.
4. Brushes may not be bedded properly on the commutator, causing them to heat excessively.

It will be found that, if no sparking or undue heating occurs at the point of contact, the pressure is equal on all the brushes, all brushes are the same type, adjusted alike and constructed of similar



materials, it is impossible then for any set of brushes to wear at a different rate than the others.

New York, N. Y. T E Murray

Brush Angle and Rotation is Important

THE BRUSHES FROM WHICH THE CURRENT flows into the commutator always wear faster than those through which the current flow is from the commutator. This additional wear is caused by small particles of carbon being carried by the current from the brush contact surface and being deposited on the commutator. SHP fails to state the type of brush holder on his motor and I should like to emphasize that if he has reaction brush holders, the angle as well as the direction of rotation of the commutator is of paramount im-

portance. He should check the following: unequal brush pressure, grade of carbon, rough commutator, brushes loose in holder, brushes with insufficient carrying capacity, load conditions and ratio of brush area to commutator surface; if the trouble still persists he should consult the motor manufacturer or a brush manufacturer for advice.

Schenectady, N. Y. CARL BACHMANN

Check Brush Setting

THE TROUBLE THAT SHP IS HAVING with brushes on his motor, in my opinion, is caused by improper setting. If the two brushes mentioned wear faster than the other two, check the arms for equidistant spacing around the commutator. The spacing can be checked by wrapping a strip of paper around the commutator then placing the brushes in their holders and marking the paper at the toe of each brush. Then move the brushes to the correct commutating zone.

Boone, N. C. S M AYERS

Bearings Out of Line

THE BRUSHES FROM WHICH THE CURRENT flows to the commutator always wear away faster than those through which the flow is from the commutator.

The brushes with current flow to the commutator would be positive on a motor and negative on a generator. A difference in resistance in the shunts from the brushes to the brush holder, or a difference in the tension on the brushes would cause an unequal distribution of the current between the brushes and unequal wear.

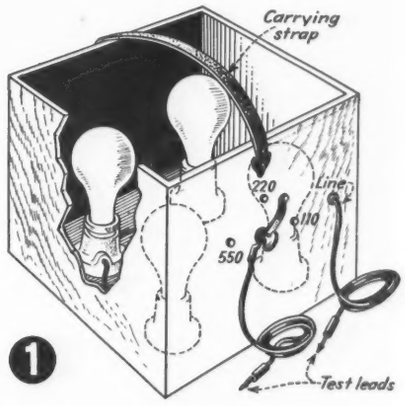
With such a condition as expressed by SHP the first thing to be investigated is the tension in the springs. He may be using brushes of different material in the different brush holders. If the worn brushes were from both polarities I would inspect for bent drive shaft, bearings out of true, or improper clearance between field and armature, at some point in the field.

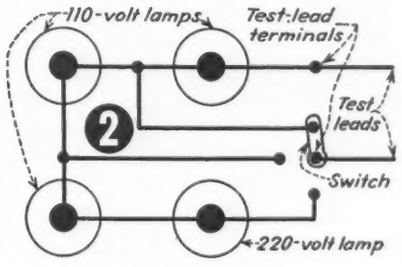
Philadelphia, Pa. W T MULLEN

Test Set Serves Three Voltages

SECONDARY CIRCUITS ON OUR SWITCHBOARD and in other parts of the plant operate at either 110, 220 or 550 volts. To be able to test any of these circuits with a single unit I rigged up the set, Fig. 1. As shown, lamps are arranged in a box that can be conveniently carried by a strap. One 220-volt and three 110-volt lamps are used, connected as in Fig. 2.

Four leads from the lamps go to terminals in one side of the box, with three of them arranged so that one may be selected with a switch according to the voltage of the circuit to be tested.





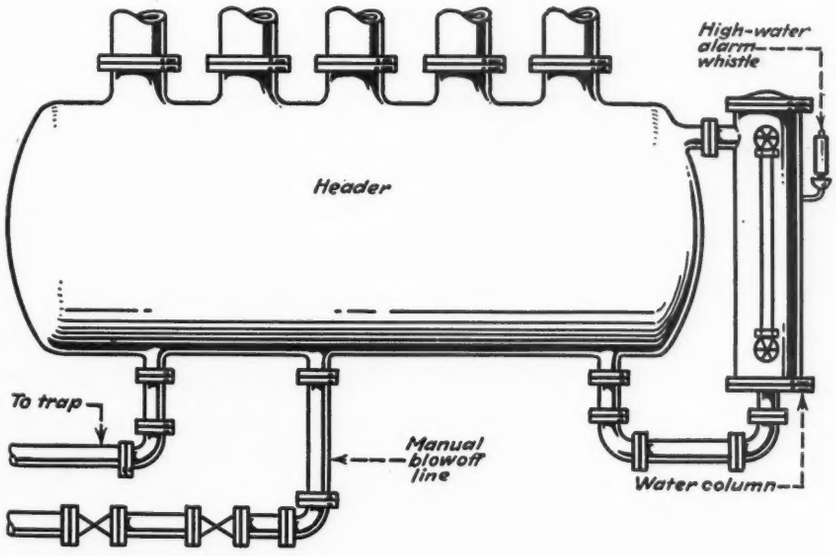
Two flexible test leads complete the job. These leads have heavily insulated terminals on their free ends for safety.

With the switch on its right-hand terminal one 110-volt lamp is in circuit. Placing the switch on its center contact puts two 110-volt lamps in series for 220-volt testing. When the switch is on its left-hand contact the 220-volt lamp and three 110-volt lamps are in series for 550-volt testing. Thus any one of three voltages can be taken care of by moving the switch.

If a 220-volt lamp cannot be obtained conveniently, use two more 110-volt lamps in series, making a total of five lamps. Most power systems operate at approximately 120, 240 and 480 volts. For such systems the connections, Fig. 2, are suitable for all three voltages by using four 120-volt lamps.

Eagle River, Ont. KENNETH COLLINS

Operating Shorts



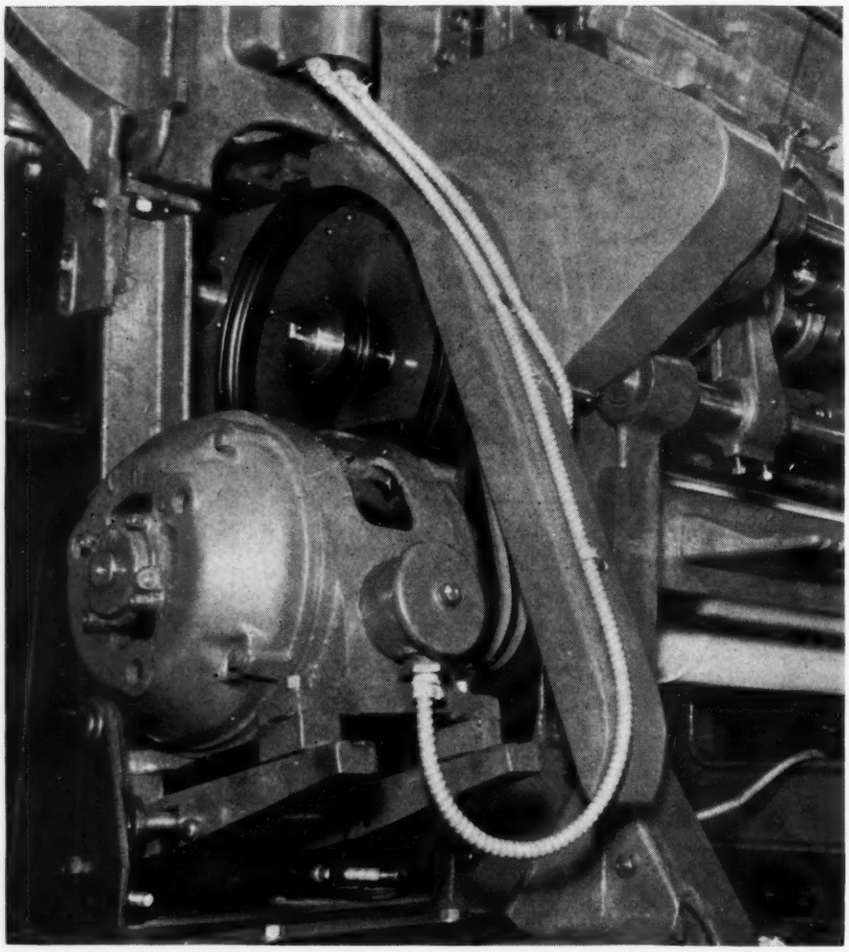
High-Water Alarms Safeguard Turbines

RELIABILITY WAS CONSIDERED TO BE the most important factor in the design of a recently built industrial power station. To insure continuity of service, every method of preventing operating and maintenance troubles had been incorporated into both the steam and power-generating sections of the plant. Of these refinements, the method of safeguarding the turbines against damage by slugs of water which might be carried into the blading with the steam is especially interesting.

Main steam headers are located underneath the turbines and are made purposely with a large storage capacity. As shown in the diagram these headers are drained with traps or drainers supplemented by a line connected to the main boiler blowoff system. To aid operators in detecting accumulation of liquid because of a trap failure or excessive carryover from the boilers, each header is provided with a water column, gage glass and a high-water alarm device. Since the plant has been in service instances have occurred when this system has prevented serious trouble.

Chicago, Ill. R C HENDERSON

PRACTICAL AIDS TO OPERATION



Simplified Drive Solves Speed Problem

QUICK STARTING AND CLOSE SPEED ADJUSTMENT is required for motor drives on double-tricot fabric-knitting machines built by Alfred Hoffman, Inc, West New York, N. J. These machines were originally driven by wound-rotor motors with secondary-resistance speed control.

It was found that these motors started the machines so slowly that an objectionable marking in the fabric was produced before they reached the correct knitting speed. The small number of steps in the starting and control resistor did not permit a close selection of speeds. When a speed was selected, control-resistor heating caused an objectionable speed change. The control resistor also required considerable space for mounting on the machine, caused a power loss in its resistance and produced objectionable heat.

This problem has been solved by using a simple squirrel-cage motor connected to the machine drive shaft with a 2-strand V-belt. The motor is mounted on a base that automatically maintains correct belt tension, as in the photo, and the pitch diameter of the motor sheave can be adjusted manually to give the correct machine operating speed at all times.

Full voltage applied to the motor at starting brings the machine to full speed quickly without shock, because of the cushioning effect of the belt. Since there is no external resistance in the rotor circuit, speed is affected very little by motor temperature. In addition, the drive and its control has been simplified and its cost and maintenance reduced.

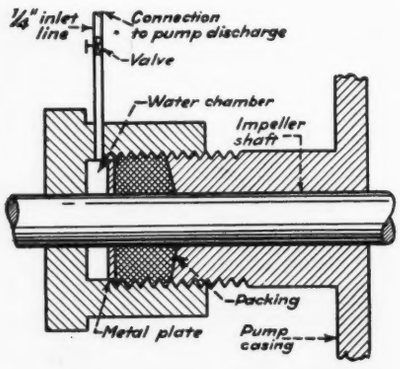
Philadelphia, Pa. J F MULLER
American Pulley Co

Water Connection Cures Packing Trouble

SEVERAL YEARS AGO in a plant where I was working we had trouble keeping the packing tight on the suction end of an old centrifugal pump. We tried several types of packing without success; the packing burned out every time and air leaked into the pump suction. The stuffing box design was like that shown in the diagram, which is not all that might be desired. When other means failed to cure the trouble we decided to put a water seal in the packing box.

This we did by welding a metal plate in the packing gland near the bottom to form a chamber $\frac{3}{8}$-in. deep and then tapping a $\frac{1}{4}$-in. hole in this chamber. We then repacked the pump, tightened the gland in place and connected the hole to the pump discharge. When the pump was again started a valve in the $\frac{1}{4}$-in. line was adjusted to permit water flow that would keep the packing cool.

The water serves as a packing and



flows out of the gland to prevent air getting in and also flows along the pump shaft to lubricate the packing and keep it cool. This change completely eliminated the packing trouble.

Cleveland, Ohio A R CIOTTI

Pulley Unbalance Makes Brushes Spark

GOOD BALANCE IN ROTATING MACHINES cannot be over-emphasized if they are to operate smoothly and quietly. Unbalance that was not noticeable has caused serious trouble. A case of this kind was experienced with a belt-driven dc generator that sparked badly at the

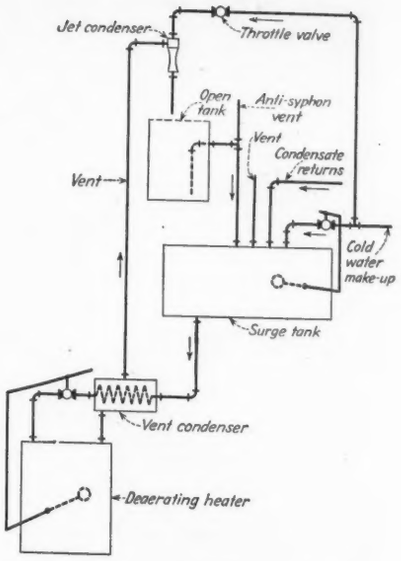
brushes. Over a period of about two years we tried all the cures for sparking commutation that are normally tried and a few others, including putting a new foundation under the machine. None of these had any effect.

One day when we sent the armature to the shop to have the commutator turned down, the pulley was also sent along. It was found that the pulley, which is nonmetallic, was worn about $\frac{1}{32}$ in. out of round and must have caused considerable armature unbalance. We turned the pulley true and carefully balanced the armature. This simple operation completely cured the commutator trouble.

Detroit, Mich. L R CARRY

Jet Condenser Recovers Deaerator-Vent Steam

IN THE USUAL DEAERATING feedwater-heater installation, appreciable quantities of steam and vapor are exhausted



to atmosphere with the vent-condenser discharge. Over a long period this heat loss adds up to something that is worth recovering if it can be done without reducing the effectiveness of the dissolved-oxygen removal from the feedwater.

There are several ways that this may be done, but the diagram shows a unique method, worked out and used in a large industrial plant. In this system the vapor and air mixture from the vent condenser is condensed in a small jet condenser, supplied with cold makeup water. The warm water and air leaving the jet-condenser discharge flows first to a small open tank and then to the surge tank.

To insure that the gases will have maximum opportunity for release, water to the jet condenser is throttled so that its discharge temperature is around 180 F. The discharge falls freely into the tank and the outlet is taken from its bottom. Both of these operations also assist in gas release. By using this system, danger of corrosion in the surge tank is practically eliminated, and deaerating effectiveness has not suffered.

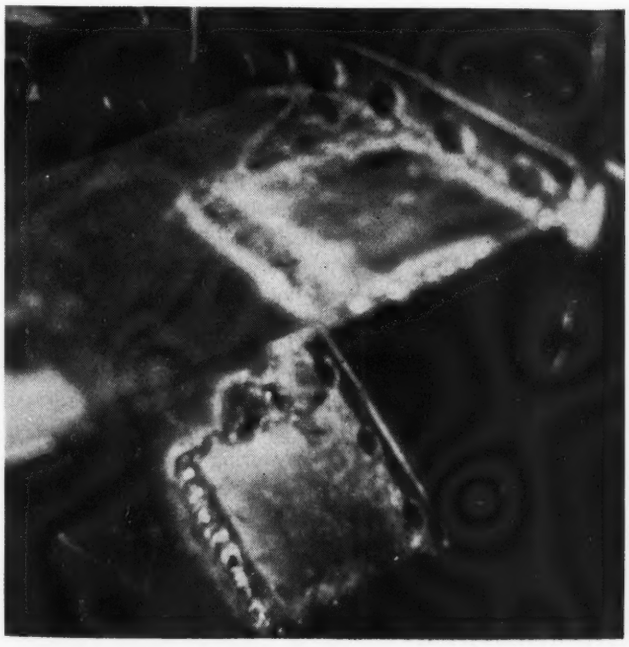
Roanoke, Va. S H COLEMAN

Welding Repairs Worn Fan Blades

OVER THREE YEARS AGO we installed two 35,000-lb-per-hr-boilers with forced- and induced-draft fans. Flyash in the flue gas eroded the induced-draft-fan blades so rapidly that two major welding jobs were required. Fig. 1, left, shows the extent of the repair on each blade after 17 months operation. Because it was necessary to keep all boilers in service whenever possible, in the first repair job $\frac{1}{8}$-in. 4x5-in. steel plates were welded on the back of the blades at the eroded areas. After the plates were welded to the blades, the thin areas of the blades were built up by welding to strengthen them. The second induced-draft fan was repaired about one month after the first one.

One of the fans operated 12 months before it needed repairing again. On the second job all of the former plate and some of the blade was cut out because of the way the blades were worn. An equal amount was cut from each blade and then a $\frac{1}{8}$-in. steel plate large enough to lap $\frac{1}{2}$ in. on the blade was welded in place, Fig. 2, right.

Welding was done with an electric arc and the cutting with an acetylene torch. All work was done by the regular maintenance crew, with a total cost of $17.00 for labor and material on each repair job, which required having a



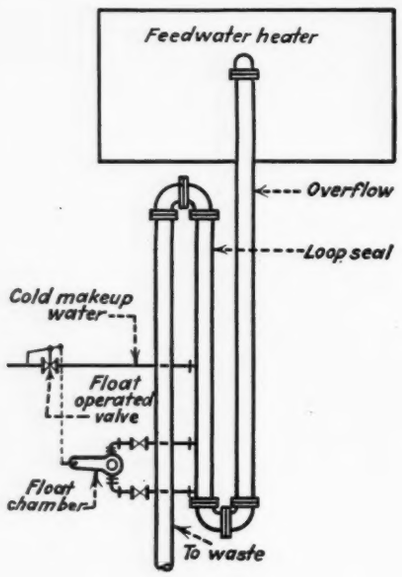
boiler out of service for only about 12 hr. No trouble has been experienced with out-of-balance of the fan rotors. We were careful to cut the plates to the same weight and to use an equal weight of welding rod on each blade. When the job was done, only a small amount of balancing was necessary.

Each time the blades have been welded they have given as good service as the original ones.

Bismark, N. D. LESLIE BRADLEY

Float Valve Controls Sealing-Water Makeup

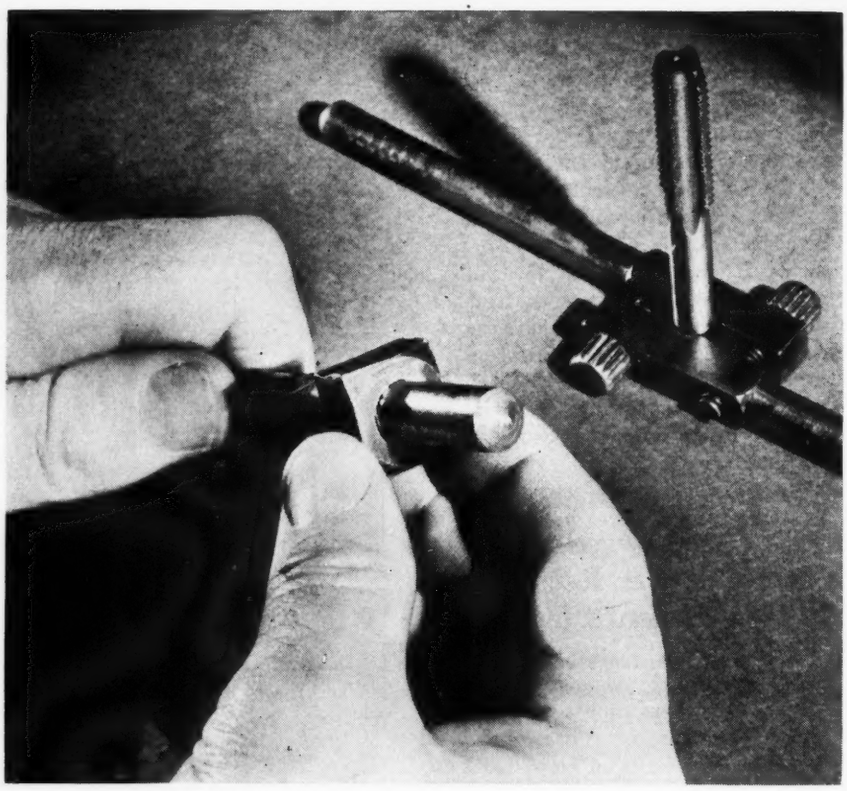
FEEDWATER HEATERS OPERATING at low pressures and located high enough to permit proper sealing are ordinarily provided with a water-sealed loop trap in the overflow piping, as in the diagram. Heaters placed at lower elevations or operating at pressures above the range in which a loop-seal trap is practical must necessarily be equipped with some form of mechanical trap or drainer.



If a pipe-loop trap is built in the overflow piping, provisions should be made to refill the loop if the pressure rises so that liquid will be blown from the seal. Sealing water can be replaced by intentionally overflowing the heater until sufficient water enters the loop to form an effective trap. This procedure, however, requires time and will complicate badly disarranged operating conditions in an emergency. A more practical method is to run a raw-water sealing line to the loop, controlled by a float-operated valve, as done in one plant and shown in the diagram.

Automatic sealing-water regulation quickly restores heater steam pressure if the seal is lost, relieves the operator of this chore so that he can immediately locate and correct the source of overpressure and eliminates water waste which might occur should the sealing valve be left open after the seal had been restored.

St. Louis, Mo. O C MILLS



Drill-Size Selection for Tap Holes

A CHART OF DRILL SIZES FOR THREADED HOLES is not always available, therefore when boring such holes it may be necessary to select the drill size by measurement or by guess work. When I have to select a drill to bore a hole for threading I use an old marine engineers' stunt. First I get a nut that will fit the bolt or stud that is to go into the threaded hole. Then I select a drill of a size that will just go into the nut. The photo shows the drill being tried for size in the nut.

When a choice must be made between a slightly oversize or undersize drill, first look at the thread in the nut. If the thread is full depth, select the oversize drill. If the thread is not full depth choose a drill that will just go into the nut or is slightly undersize. When there is any doubt about the drill size select one that is slightly smaller than the nut bore. If this is too small for the tap then the next larger size drill can be run into the hole.

New York, N. Y. S M ELONKA

Keeping Liquid-Level Controls on the Job

FLOAT-CONTROL MAINTENANCE is largely preventive. At scheduled intervals the valve or other device controlled by the float should be cleaned, inspected, and repaired if necessary. Packing in the various glands should be kept soft and well-lubricated in order to avoid binding or sluggish operation. Linkages, bearings and fulcrum points must of course be kept clean and oiled occasionally to insure freedom of movement.

Sometimes hollow floats will develop leaks and either become sluggish or lose their buoyancy altogether. Should this happen it will often prove economical to make permanent or at least temporary repairs so that it can be retained in service during the interval required to secure a new one. It is necessary to drain the liquid from the interior of the float and then to locate and repair the leak.

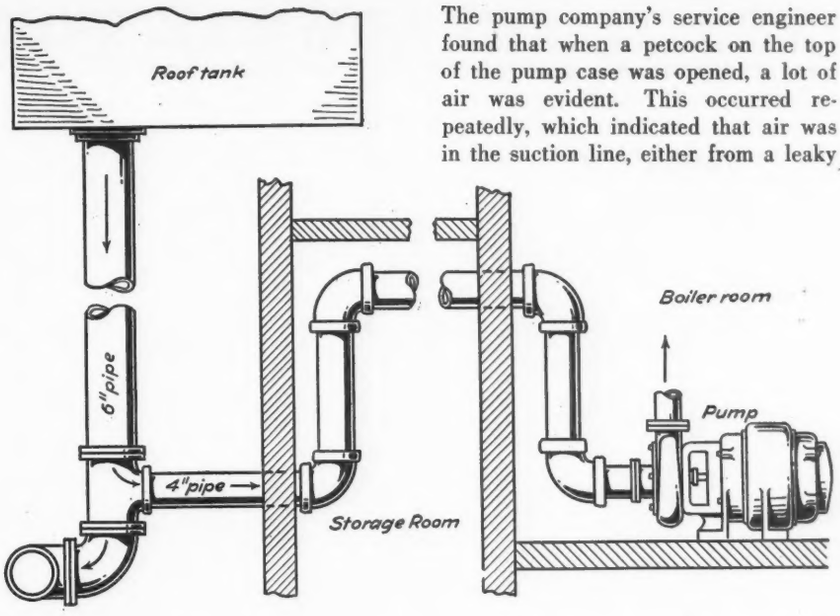
A small hole drilled in the float will drain out the liquid. To locate the leak

the following procedure is recommended. After all liquid has been removed from the float solder the drain hole shut. Then immerse the float in a vessel containing hot water. This will cause the air within the float to expand and escape through the leak and form bubbles in the water that will indicate the leakage point. Once the leak has been found it can be soldered or brazed closed.

Roanoke, Va. S H COLEMAN

Avoid Air Traps in Pump Suction Lines

WHEN INSTALLING A CENTRIFUGAL PUMP it is essential that the suction line be laid out so that there are no air traps in it, since these tend to reduce the pump's capacity and may even cause it to lose its prime. Trouble caused by a suction air trap was found recently in an industrial plant, where the suction piping from the roof tank to a centrifugal pump was arranged as in the figure. A water softener was installed and it was expected there would be sufficient pressure from the roof tank for backwashing the filter. An air trap or upward loop in the line, as shown in the figure, was not noticed, because it happened to be in another room near the ceiling. When it was found that sufficient water for backwashing would not flow through the pipe a centrifugal pump was installed.



When the pump was put into operation no more water flowed than before, and immediately the pump was blamed. The pump company's service engineer found that when a petcock on the top of the pump case was opened, a lot of air was evident. This occurred repeatedly, which indicated that air was in the suction line, either from a leaky line or an air trap. Following the suction line back, the air trap was quickly located, after which the loop was eliminated. This permitted the pump to operate at rated head and capacity. However, if the pipe had been properly installed at first the pump probably would not have been required.

New York, N. Y. FRANK A KRISTAL

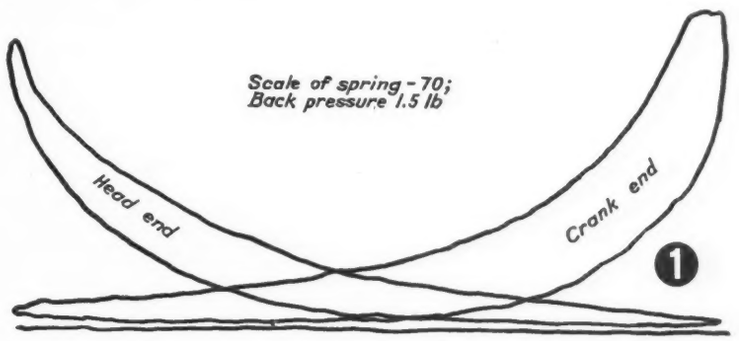
Sluggish Governor Causes Engine Trouble

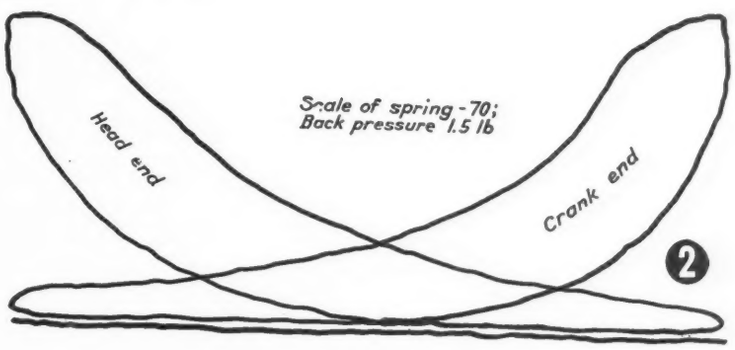
WE HAVE A 400-HP, 150-rpm steam engine direct-connected to a 250-kw dc generator. We indicate our engines every two months and recently when we took cards from this engine, with a generator load of 70 kw, the area of the head-end card was smaller than the crank-end one, Fig. 1. We made the necessary valve-gear adjustments to correct this condition, but were surprised on reindicating the engine that the crank-end card was much smaller than the head-end one.

As we do not consider ourselves experts on steam indicators, we were puzzled, because this engine had operated perfectly for several years. We happened to be standing near the gage board discussing our next step to locate the trouble when we noticed a slight fluctuation of the back pressure gage. A slight fluctuation was also noticed in the voltage, which confirmed our suspicions that the engine was hunting.

We shut down the engine and checked the governor, which is equipped with a dashpot to assist in stabilizing its operation. It was found that some of the dashpot inner parts were slightly worn and after making some minor adjustments, we filled it with a heavier oil than that previously used. When the engine was again put into service it operated perfectly, as indicated by the cards for a load of 115 kw, Fig. 2.

Bronx, N. Y. ANTHONY GREER





Steam Table Drills—No. 3

Adding Heat to Water and Steam

By PHIL SWAIN

THIS MONTH, again, we deal with "enthalpy" and nothing else. Last month, after extensive apologies to the makers of exact definitions, we showed how easy it is to solve problems with the steam-table enthalpies if you don't have to split hairs too fine. Any practical engineer who is satisfied with an answer correct to a fraction of one percent, can use the following rule for all cases of simple heating and cooling where the pressure is not over 500 lb.

The heat required to convert liquid water at any initial temperature, or steam at any initial pressure, temperature and condition, to liquid water at any final temperature or steam at any final pressure, temperature and condition, is the difference in enthalpy between the two states.

Liquid Water

In the case of liquid water, take the enthalpy as that of saturated liquid water at the given temperature. In the case of superheated steam read the enthalpy directly from Table 3. In the case of dry saturated steam read the enthalpy directly from Table 2 or 3. In the case of wet steam multiply the enthalpy of evaporation by the dryness factor and add the enthalpy of saturated liquid water.

In each of these cases, except for wet steam, the enthalpy is read directly from the steam tables. Here are some typical applications of this rule:

Problem 1—*Starting with one pound of feedwater at 206 F, how much heat must be added to convert it to steam at 184 lb absolute pressure and 500 F?*

SOLUTION:

Enthalpy of steam (Fig 3) .....1270.60 Btu
Enthalpy of water (Fig 1) ..... 174.03 Btu

Heat required (diff) 1096.57 Btu

Problem 2—*If the boiler of Problem 1 generates 10.2 lb of steam per pound of 13,200 Btu coal, what is the overall efficiency?*

SOLUTION:

Efficiency = output ÷ input
= (1096.6 × 10.2) ÷ 13,200 = 0.847 = 84.7%

Problem 3—*How much heat must be added to one pound of 95% dry steam at 180 lb absolute to superheat the steam to a total temperature of 560 F.* (This will be worked entirely from Fig. 3.)

SOLUTION:

Enthalpy of vaporization is 1196.9 —346.0 = 850.9 Btu
Enthalpy of wet steam = 346.0 + (0.95 × 850.9) = 808.4 + 346.0 = 1154.4 Btu
Enthalpy of superheated steam = ...1302.8 Btu
Enthalpy of wet steam...1154.4 Btu

Heat added ..... 148.4 Btu

All references to steam tables in this series are to the "Thermodynamic Properties of Steam (1936 Edition), by Keenan and Keyes, published by John Wiley & Sons, Inc., New York. Sections reproduced by permission of the publishers.

Table 1. Saturation: Temperatures

Temp. Fahr.	Abs. Pressure Lb. per Sq. In.	Abs. Pressure In. Hg.	Specific Volume Sat. Liquid	Specific Volume Evap.	Specific Volume Sat. Vapor	Enthalpy Sat. Liquid	Enthalpy Evap.	Enthalpy Sat. Vapor	Entropy Sat. Liquid	Entropy Evap.	Entropy Sat. Vapor	Temp. Fahr.
t	p		v_f	v_{fg}	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	t
90°	0.6982	1.4215	0.01610	468.0	468.0	57.99	1042.9	1100.9	0.1115	1.8972	2.0087	90°
91	0.7204	1.4667	0.01611	454.4	454.4	58.99	1042.4	1101.4	0.1133	1.8927	2.0060	91
92	0.7432	1.5131	0.01611	441.2	441.3	59.99	1041.8	1101.8	0.1151	1.8883	2.0034	92
93	0.7666	1.5608	0.01611	428.5	428.5	60.98	1041.2	1102.2	0.1169	1.8838	2.0007	93
94	0.7906	1.6097	0.01612	416.2	416.2	61.98	1040.7	1102.6	0.1187	1.8794	1.9981	94
200°	11.526	23.467	0.01663	33.62	33.64	167.99	977.9	1145.9	0.2938	1.4824	1.7762	200°
202	12.011	24.455	0.01665	32.35	32.37	170.00	976.6	1146.6	0.2969	1.4760	1.7729	202
204	12.512	25.475	0.01666	31.14	31.15	172.02	975.4	1147.4	0.2999	1.4697	1.7696	204
206	13.031	26.531	0.01667	29.97	29.99	174.03	974.2	1148.2	0.3029	1.4634	1.7663	206
208	13.568	27.625	0.01669	28.86	28.88	176.04	972.9	1148.9	0.3059	1.4571	1.7630	208

Fig 1—Extract, Table 1, Keenan & Keyes, "Saturation: Temperature"

Table 2. Saturation: Pressures

Abs. Press. Lb. per Sq. In.	Temp. Fahr.	Specific Volume Sat. Liquid	Specific Volume Sat. Vapor	Enthalpy Sat. Liquid	Enthalpy Evap.	Enthalpy Sat. Vapor	Entropy Sat. Liquid	Entropy Evap.	Entropy Sat. Vapor	Internal Energy Sat. Liquid	Internal Energy Evap.	Internal Energy Sat. Vapor	Abs. Press. Lb. per Sq. In.
p	t	v_f	v_g	h_f	h_{fg}	h_g	s_f	s_{fg}	s_g	u_f	u_{fg}	u_g	p
170	368.41	0.01822	2.675	341.09	854.9	1196.0	0.5266	1.0324	1.5590	340.52	771.4	1111.9	170
172	369.35	0.01823	2.645	342.10	854.1	1196.2	0.5278	1.0302	1.5580	341.52	770.5	1112.0	172
174	370.29	0.01824	2.616	343.10	853.3	1196.4	0.5290	1.0280	1.5570	342.51	769.7	1112.2	174
176	371.22	0.01825	2.587	344.09	852.4	1196.5	0.5302	1.0259	1.5561	343.50	768.8	1112.3	176
178	372.14	0.01826	2.559	345.06	851.6	1196.7	0.5313	1.0238	1.5551	344.46	767.9	1112.4	178

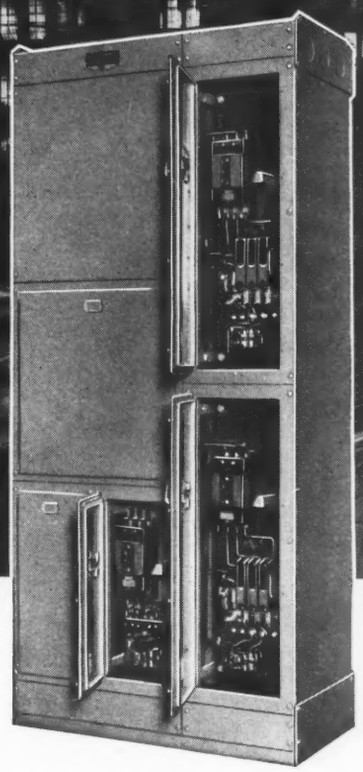
Fig 2—Extract, Table 2, Keenan & Keyes, "Saturation: Pressure"

Table 3. Superheated Vapor

Abs. Press. Lb./Sq. In. (Sat. Temp.)		Sat. Liquid	Sat. Vapor	Temperature—Degrees Fahrenheit 380°	390°	400°	420°	440°	460°	480°	500°	520°	540°	560°	580°	600°	620°
	v	0.018	2.532	2.563	2.606	2.649	2.732	2.813	2.891	2.969	3.044	3.119	3.193	3.266	3.339	3.411	3.482
180	h	346.0	1196.9	1201.4	1207.8	1214.0	1226.1	1237.8	1249.1	1260.2	1271.0	1281.7	1292.3	1302.8	1313.2	1323.5	1333.8
(373.06)	s	0.5325	1.5542	1.5596	1.5672	1.5745	1.5884	1.6015	1.6139	1.6258	1.6373	1.6483	1.6590	1.6694	1.6795	1.6894	1.6990
	v	0.018	2.505	2.532	2.575	2.617	2.700	2.780	2.858	2.934	3.009	3.084	3.157	3.229	3.301	3.372	3.443
182	h	347.0	1197.0	1201.0	1207.4	1213.7	1225.8	1237.5	1248.8	1259.9	1270.8	1281.5	1292.1	1302.6	1313.0	1323.4	1333.7
(373.96)	s	0.5336	1.5532	1.5580	1.5656	1.5729	1.5869	1.6000	1.6125	1.6244	1.6359	1.6470	1.6577	1.6681	1.6782	1.6880	1.6977
	v	0.018	2.479	2.501	2.544	2.586	2.668	2.748	2.825	2.901	2.975	3.049	3.121	3.193	3.264	3.334	3.404
184	h	348.0	1197.2	1200.6	1207.0	1213.3	1225.5	1237.2	1248.6	1259.7	1270.6	1281.4	1292.0	1302.5	1312.9	1323.3	1333.6
(374.86)	s	0.5348	1.5523	1.5564	1.5640	1.5714	1.5854	1.5986	1.6111	1.6230	1.6345	1.6456	1.6563	1.6667	1.6769	1.6867	1.6964
	v	0.018	2.454	2.472	2.514	2.556	2.637	2.716	2.793	2.868	2.942	3.015	3.086	3.157	3.228	3.297	3.367
186	h	348.9	1197.3	1200.2	1206.6	1212.9	1225.2	1236.9	1248.3	1259.5	1270.4	1281.2	1291.8	1302.3	1312.7	1323.1	1383.4
(375.75)	s	0.5359	1.5514	1.5548	1.5625	1.5699	1.5839	1.5971	1.6097	1.6217	1.6332	1.6443	1.6550	1.6654	1.6756	1.6854	1.6951
	v	0.018	2.429	2.443	2.485	2.527	2.607	2.685	2.761	2.836	2.909	2.981	3.052	3.123	3.192	3.261	3.330
188	h	349.9	1197.5	1199.7	1206.2	1212.6	1224.8	1236.6	1248.1	1259.2	1270.2	1281.0	1291.6	1302.1	1312.6	1323.0	1333.3
(376.64)	s	0.5370	1.5506	1.5532	1.5609	1.5683	1.5824	1.5957	1.6083	1.6203	1.6318	1.6429	1.6537	1.6641	1.6743	1.6842	1.6938

Fig 3—Extract, Table 3, Keenan & Keyes, "Superheated Vapor"

3 Facts of Vital Importance to Production Today



With every moment of time, every foot of production space, every work unit of manpower of such vital importance, look to Unitrol to wipe out the problem of handling, housing and using Motor Control.

1 Unitrol simplifies and speeds up the installation of Motor Control whether *inside* a machine, *beside* a machine or in a control center serving an entire plant or department.

2 Unitrol simplifies and speeds up the addition, change, replacement and servicing of Motor Control. It makes control always easily accessible . . . separates control from machine, maintenance from production. It keeps control abreast of changing needs.

3 Unitrol cuts down the space required by Motor Control . . . enables you to get more than double the amount of control in the same space . . . may even make plant extensions unnecessary.

The complete Unitrol story is told in the book "Unitrol . . . the next step forward in Motor Control progress." It's yours for the asking. But send for it *today*. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

1892-1942 50th ANNIVERSARY

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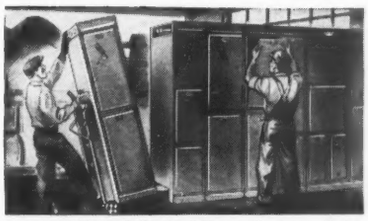
Unitrol is a *better* method of mounting, housing and *centralizing* Motor Control . . . from the individual unit up to the complete plant-serving motor control center. It is made up from standardized interchangeable parts. It is complete and usable at every step of the way. It is inexpensive, speedy and easy to install, demount or change. It is as "flexible as a rubber band."

The individual Unitrol *Section* houses Motor Control for several motors or motorized machines, is compact, space-saving, convenient and economical. No supports, no other structures or preparation necessary.

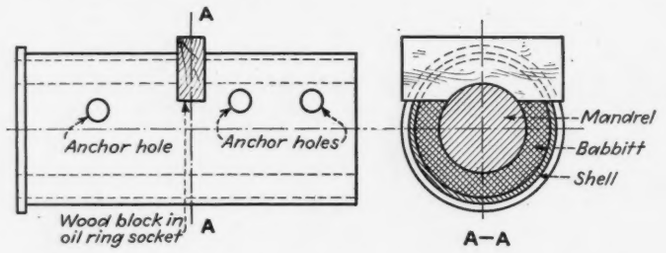
The individual Unitrol mounting frame is *better* for machines with built-in Motor Control. It eliminates many machining, wiring and assembling operations.



The complete Unitrol Control Center houses all the control and control equipment in the plant, for easy, speedy man-power-saving installation, maintenance, change, expansion or curtailment. No wall or floor preparation. No racks, trellises or frames. Permits installation of more than double as much control in same space.

HOW TO BABBITT A SLEEVE BEARING

THE following step-by-step procedure for rebabbitting shell-type motor sleeve bearings was pictured by POWER's photographer in cooperation with The Maintenance Co, 453 West 42nd St, New York, N. Y.



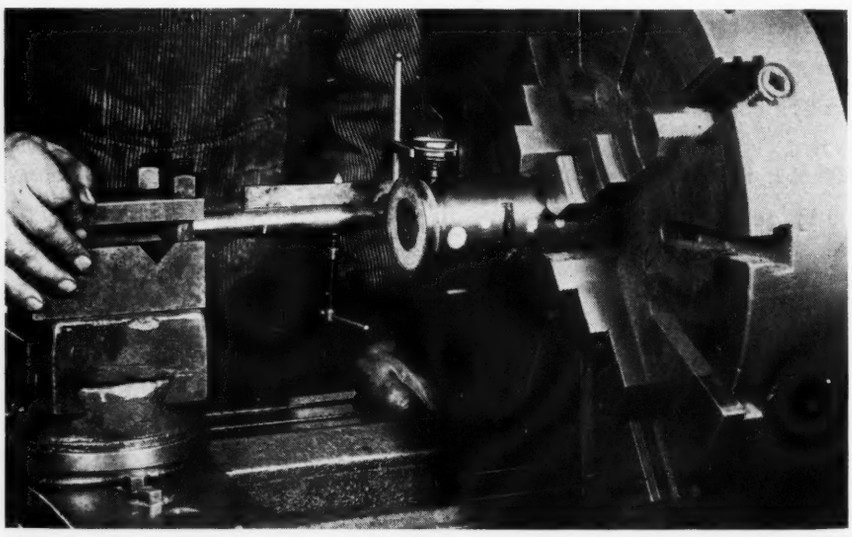
1 After melting out old babbitt and inserting wooden piece (see sketch above) to block off oil-ring slot, wrap the shell with asbestos paper to seal babbitt anchor holes. Apply friction tape to hold paper in place

2 Stand shell, end up, on a piece of asbestos paper laid on a metal slab, and pack asbestos cement around bottom to prevent escape of molten metal. Center a previously warmed steel mandrel in shell. Mandrel diameter should be about ⅛ in. smaller than motor shaft. Babbitt temperature is correct when it will just char a soft pine stick.

3 Pour shell completely full of babbitt

5 Chuck bearing in lathe until it runs true, checking with dial indicator or chalk

4 Drill through babbitt at bottom oil-drain hole at each end of bearing



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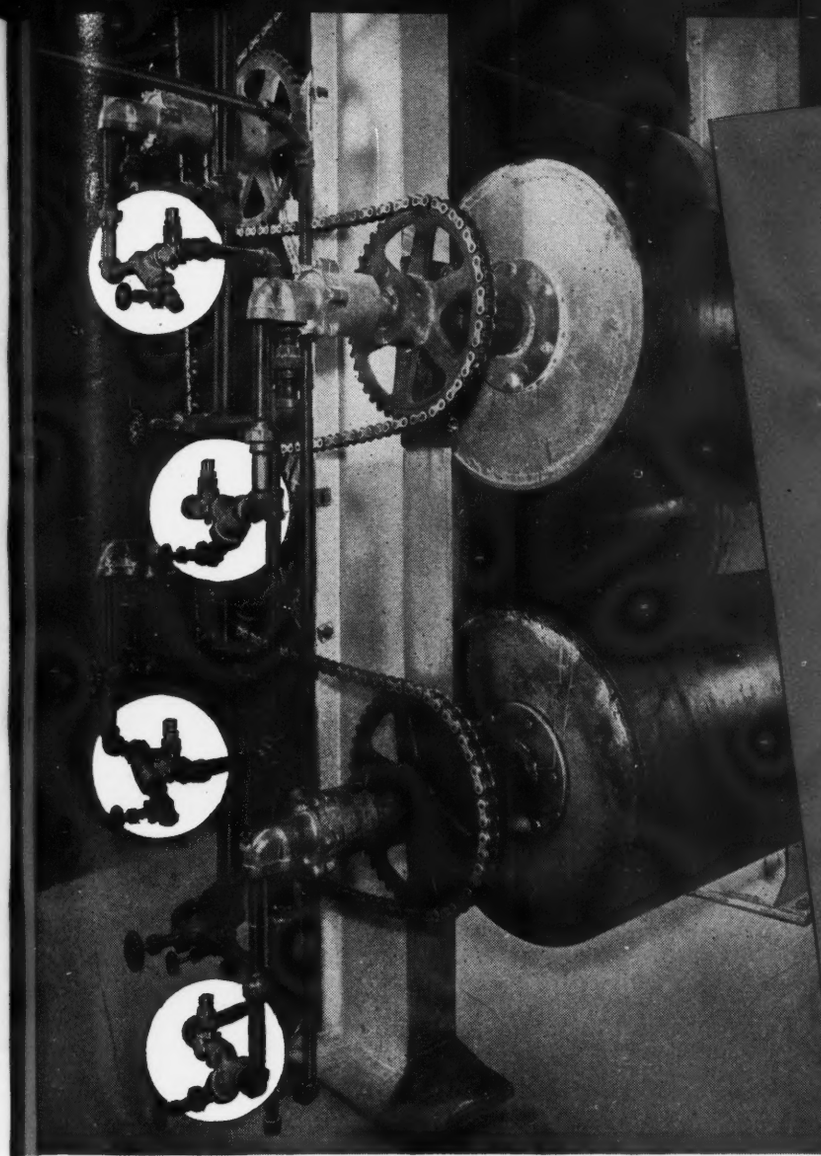

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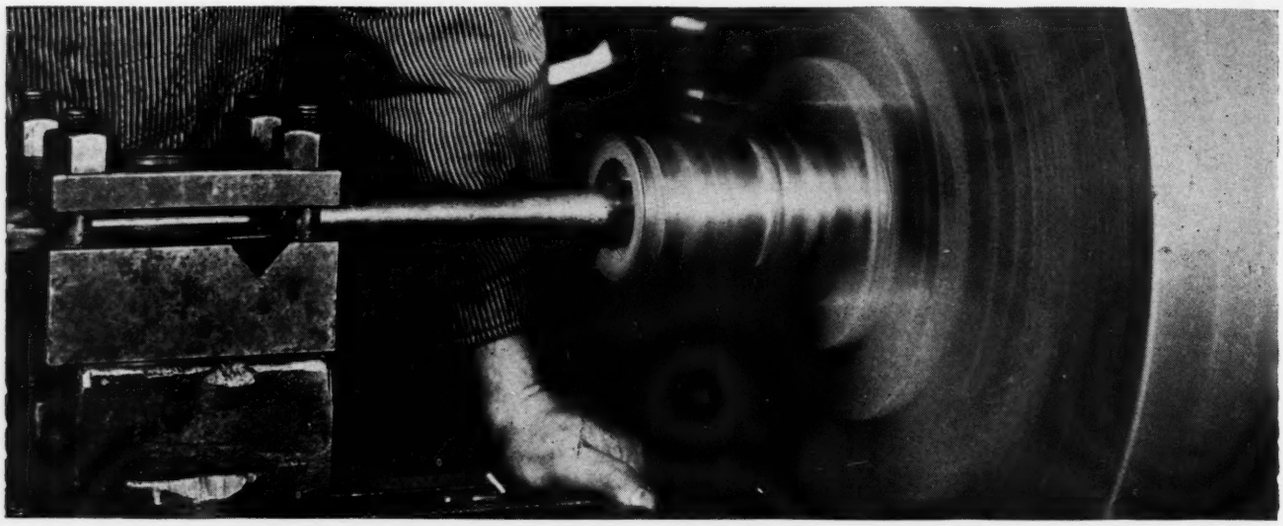
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia, Pa.

YARWAY IMPULSE STEAM TRAP

HOW TO BABBITT A SLEEVE BEARING

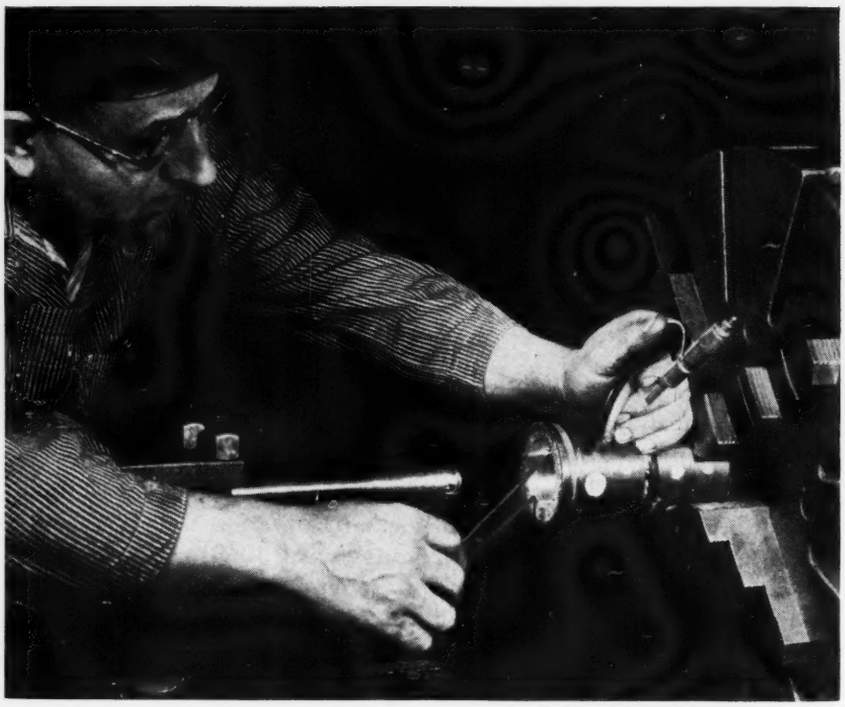
CONTINUED FROM PAGE 110

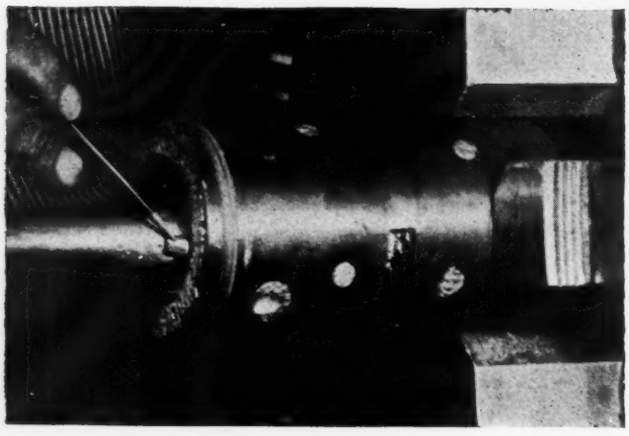


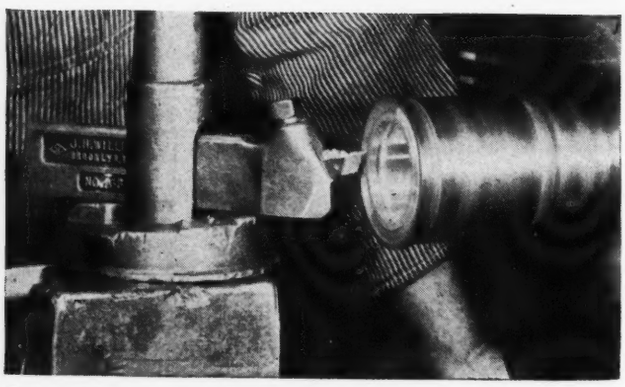
6 **Turn the inside with boring tool**

7 **Turn the bore to a diameter slightly larger than motor shaft. In general the diametrical clearance should run about 0.001 in. per inch of shaft diameter**

8 **Use round-nose boring bit to cut two circumferential oil grooves in line with the two bottom oil-drain holes. Then turn boring bar 180 deg and cutter bit 90 deg, as shown in photo, and machine longitudinal oil grooves by traversing lathe carriage by hand with chuck stationary. Bit operates like a shaper tool. There should be two such grooves extending from one circumferential groove to the other, each just touching one end of the oil-ring slot. Some maintenance men carry the longitudinal grooves through from one circular groove to the other, but it is more common to stop them about ⅛ in. short**







9 **Finish bearing by facing babbitt on both ends**

Local Turbulence Creates Rapid Tube Failure

Tubes consistently failed at the second-pass inlet end. Inspection revealed that the reverse-flow waterbox was divided horizontally at the center by an open reinforcing diaphragm which had openings which constituted only 56% of its area. These restricted openings caused increased local velocity and turbulence, with resultant release of air from solution. The changes recommended by Scovill were inexpensive and entirely successful in stopping the rapid second-pass tube-end failure.

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Load-Center Distribution Systems Save Strategic Materials

Comparison of a modern load-center power-distribution system with the old low-voltage radial system shows saving of material, cost and engineering, and improved performance

▶A REVIEW OF POWER-DISTRIBUTION SYSTEMS made with the objective of improving existing methods, led to the development of the load-center distribution principle for industrial plants and for other applications where the problems are similar, according to a paper presented by D L Beeman and R H Kaufmann of the General Electric Co before the recent winter convention of the American Institute of Electrical Engineers. Load-center distribution has already been adopted for many major war plants and for the extension of existing manufacturing facilities. In the old method a single substation is used in which a large block of power is transformed from high to low voltages for distribution throughout the factory through a system of long, heavy feeders as in Fig. 3.

The authors compared these two distribution systems for a typical medium-size factory, 400 x 700 ft, having a 3000-kva demand, a load density of 10 volt-amp per sq ft, and supplied from two 13.2-kv power-company lines stepped down to 480 volts. Both systems are radial, Fig. 2 and 3, and are designed to give comparable service continuity.

Material and Cost Savings

An outstanding advantage of load-center distribution under present conditions is that it requires less strategic materials. Because low-voltage feeder runs are short, there is a large copper saving. There is also some saving in steel but a slight increase in use of other materials, principally insulation. A comparison of the materials required for load-center distribution and for the old conventional distribution system is shown in Fig. 4.

Investment in secondary cables is materially decreased for load-center distribution systems because of the shortness of feeder runs. There is also a saving in substation cost because the breakers of the small units have lower interrupting capacities. The smaller transformers have less secondary short-circuit current and therefore smaller secondary feeder breakers can be used. Instead of an outdoor switching station as conventionally used, only a small, compact, indoor metalclad structure is required, which offers some reduction in cost.

For the example chosen, the cost of the old method is $56,500, including primary switching equipment, substations, and secondary cable, and the cost of the load-center power system for the same equipment, including primary cable, is only $44,500, a reduction of approximately $12,000 or 21%. These savings are shown graphically in Fig. 5. For smaller plants, the savings would be less but, the percentage should be approximately the same. As plant size increases, the savings become greater and, in general, the percentage will increase.

Because the substations of load-center systems are small and factory built, they can be added when and where needed without extensive planning as compared with the old method which involved extensive forecasting of location and magnitude of loads in order to select the most advantageous location of the large substation for present as well as future operations.

Small substations can be completely built and wired in the factory. Thus the units arrive at the site ready for operation after bolting one or two sections together and connecting the cables. For the older method, expensive and time consuming detail drawings must be made for the assembly of the different pieces of equipment. With the factory-assembled equipment, one set of drawings, made by the manufacturer, is required to build standard unit substations. Hence the drafting cost per unit is extremely small and manpower so needed for the war program is conserved. Only a simple functional specification is required for buying unit substations where the older method requires a complete specification for every part.

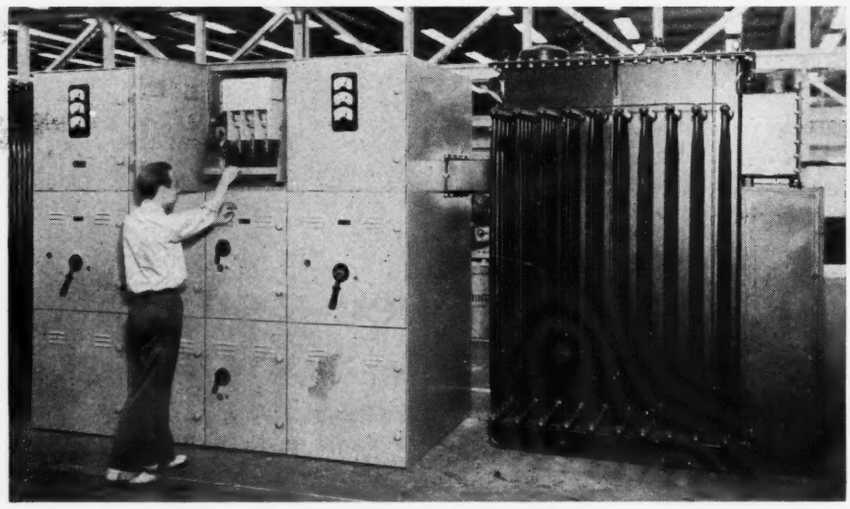

Fig. 1—Load-center substation rated 1200 kva, 2400 to 480 volts, installed on factory floor, with incoming switchgear on right, self-cooled transformer in center and draw-out air circuit breakers on left for 480-volt distribution-system feeders

Because of the shorter secondary runs, voltage drop and light flicker are less than with the conventional system. For example, voltage drop from the primary of the transformer to the end of the longest secondary of the old system, Fig. 3 is 7.5% and for the load-center system, Fig. 2, is 4.5%. The latter improves the motor and lamp per-

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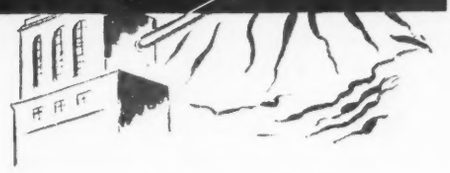

Photo in Nalco plant, Chicago, Illinois

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The Complete Water Treating Service

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Load Center Systems Save Materials

(Continued from page 114)

formance and facilitates more and better production.

A major advantage of load-center distribution is its flexibility in regard to the varying degrees of service continuity that can be obtained. For example, where the continuity requirements are not stringent, as in a warehouse, the simple radial form can be used. On the other hand, continuous processes may necessitate a more complicated and expensive secondary network to provide the highest service reliability. There are other forms of the radial system which offer intermediate degrees of service continuity.

When designing a load-center distribution system the question naturally arises: What is the most economical size of load-center unit substation? This is determined principally by the cost of the unit substation itself. Small load-center units are more expensive because small equipment is inherently more costly per kva. Above a certain size, load-center units become increasingly expensive because of the larger switchgear needed to handle the high short-circuit current of large transformer banks. The optimum size of transformers for 480-volt secondaries is generally 600 to 1000 kva. In some cases 1200- and 1500-kva units come within the limit of most economical sizes. For 240-volt or 120/208-volt circuits the most economical size of transformers is 300 to 600 kva.

To compare the performance of the various forms of load-center distribution a representative load block totaling 3000 kva with a load density of 10 volt-amp per sq ft and suited to 440-volt equipment will be considered. Control of low-tension feeders, averaging 150-kva each, is by air circuit breakers of recognized adequacy. A 13,200-volt 3-phase 60-cycle primary service is assumed with a 250,000-kva short-circuit rupturing requirement.

The simple radial system incorporates a single direct electrical channel leading to each load-center low-tension bus. All elements comprising this are considered to be normally operated at rated capacity. The lowest possible first cost is obtained and will be considered as the reference level in cost evaluation of other system forms, Fig. 6. Simplicity of electrical circuits in combination with recognized adequate capacity in all power switching equipment makes for ease of operation.

The voltage regulation between the primary high-tension bus and the low-tension feeder terminals is about 5% or less, which is not objectionable. Absense of a duplicate power supply is the outstanding deficiency of the simple radial system. Routine servicing as well as electrical faults result in power interruption.

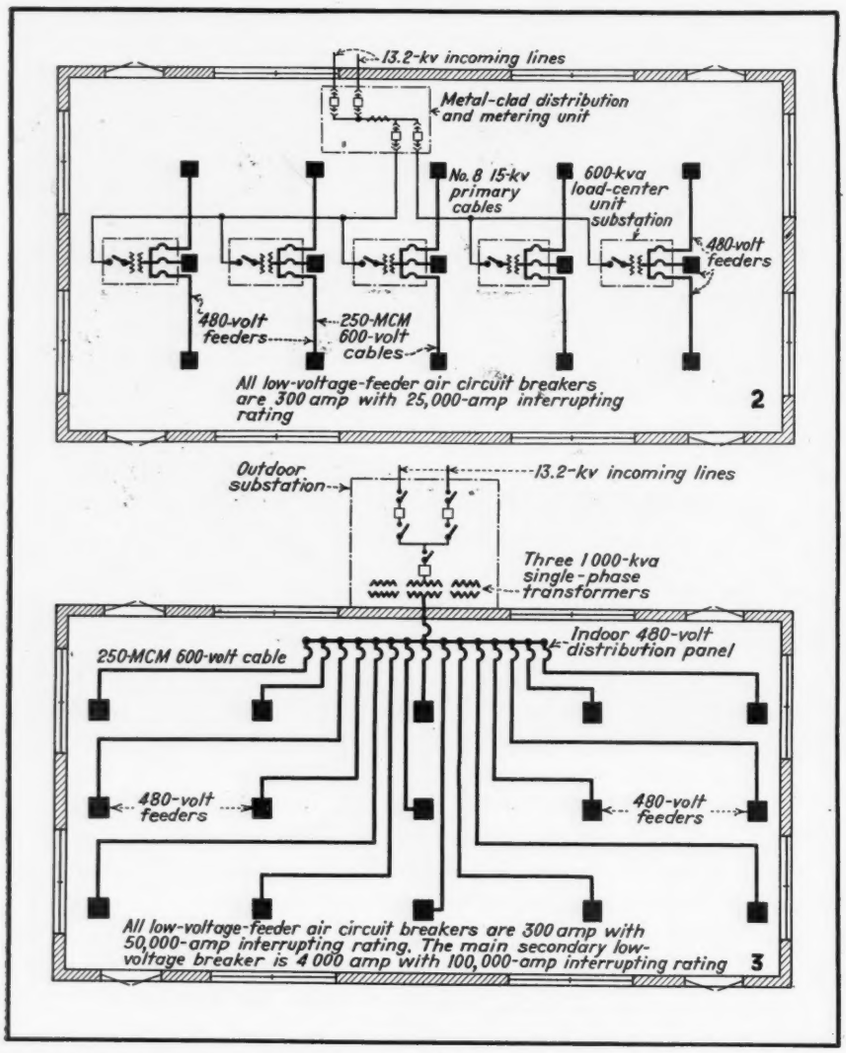
13.2-kv incoming lines
Metal-clad distribution and metering unit
No. 8 15-kv primary cables
600-kva load-center unit substation
480-volt feeders
480-volt feeders
250-MCM 600-volt cables
All low-voltage-feeder air circuit breakers are 300 amp with 25,000-amp interrupting rating
2
Outdoor substation
13.2-kv incoming lines
Three 1000-kva single-phase transformers
250-MCM 600-volt cable
Indoor 480-volt distribution panel
480-volt feeders
480-volt feeders
All low-voltage-feeder air circuit breakers are 300 amp with 50,000-amp interrupting rating. The main secondary low-voltage breaker is 4 000 amp with 100,000-amp interrupting rating
3

Fig. 2—Load-center distribution system, each load center supplied from its own transformer. Fig. 3—Low-voltage radial power-distribution system, supplied from a single bank of transformers.

Primary Selective System

In the primary selective system, Fig. 6, load-center primary selective switching is provided in combination with duplicate feeders. Service can therefore be restored to all load centers if voltage on one primary feeder fails, and an improvement in service reliability is reached at about 25% increase in cost, compared to the simple radial system. Under normal conditions the operating simplicity of the simple radial system is retained.

A reduction in operating safety is incurred by the use of the primary selective disconnecting switches. Within the limits of a 5-kv primary voltage and a 50,000-kva short-circuit interrupting requirement, full-capacity power circuit breakers can be used for transfer switching at about 5% increase in cost.

Because primary-circuit switching is required at times of emergency while normal-service switching operations are accomplished with low-tension circuit breakers, operating instructions and procedure become somewhat complicated. Trouble as a result of electrical failure, fire, or bomb explosions, could easily involve both circuits and cause a complete power loss.

The secondary selective system, Fig. 6, has a low-tension tie breaker between two sections of secondary bus, each con-

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Load Center Systems Save Materials

(Continued from page 116)

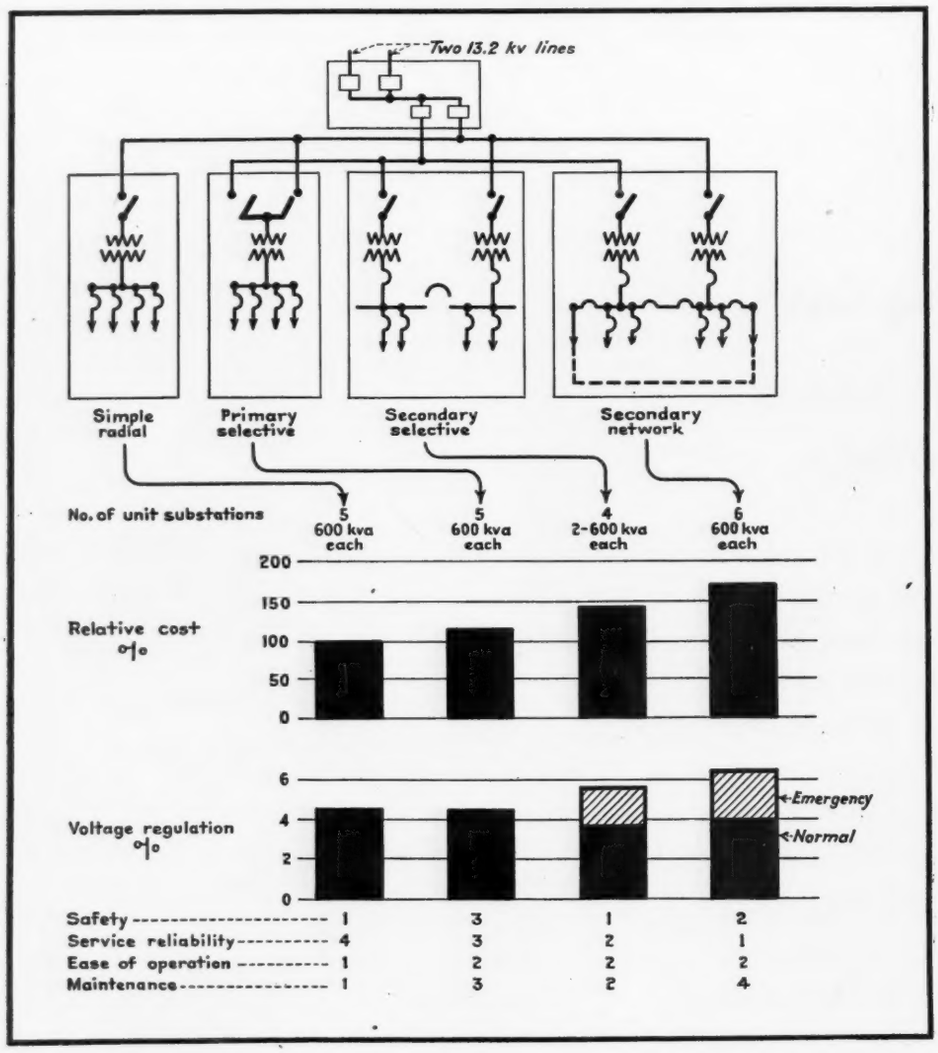


Fig. 6—Comparison of four basic circuit arrangements of load-center distribution for a typical 3000-kva plant

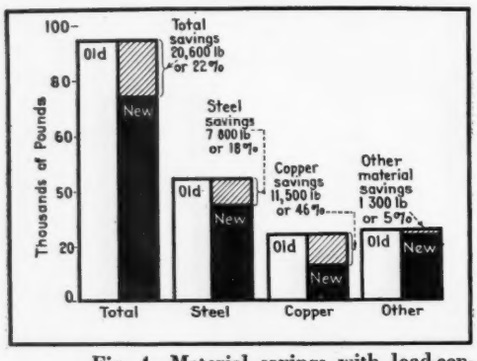


Fig. 4—Material savings with load-center distribution for given conditions

nected to a different primary feeder. This is normally operated as a simple radial system with the tie breaker open. Reserve transformer capacity is provided to permit the combined load of the two sections to be carried on one transformer without exceeding 125% of its rated capacity. On this basis, the first cost becomes about 145% compared to the simple radial form or about 20% above the primary selective. If load curtailment can be permitted during emergency operation, the first cost can be materially reduced.

Electrical faults affecting service on one primary feeder cannot interfere with service on the other. Even closure of the low-tension tie breaker on a solid fault will not disrupt primary-feeder power. All normal switching, with the exception of transformer routine inspection, is performed with full-capacity, low-tension air circuit breakers which make for operating simplicity and safety under any contingency.

Increased system cost is largely invested in active material (primary-cable and transformer kva) which returns benefits in the form of reduced losses, better regulation, and freedom from temperature trouble. By operating the tie breaker electrically automatic transfer can be obtained, limiting

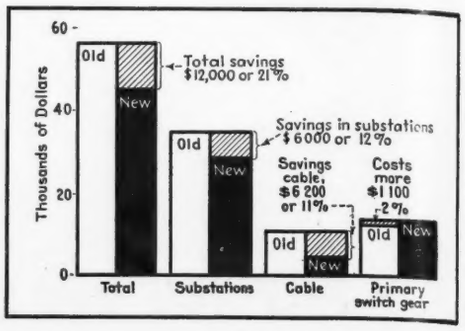


Fig. 5—Cost reduction with load-center distribution for same conditions as Fig. 4

power interruption to a very short duration, thus closely approaching 100% service reliability.

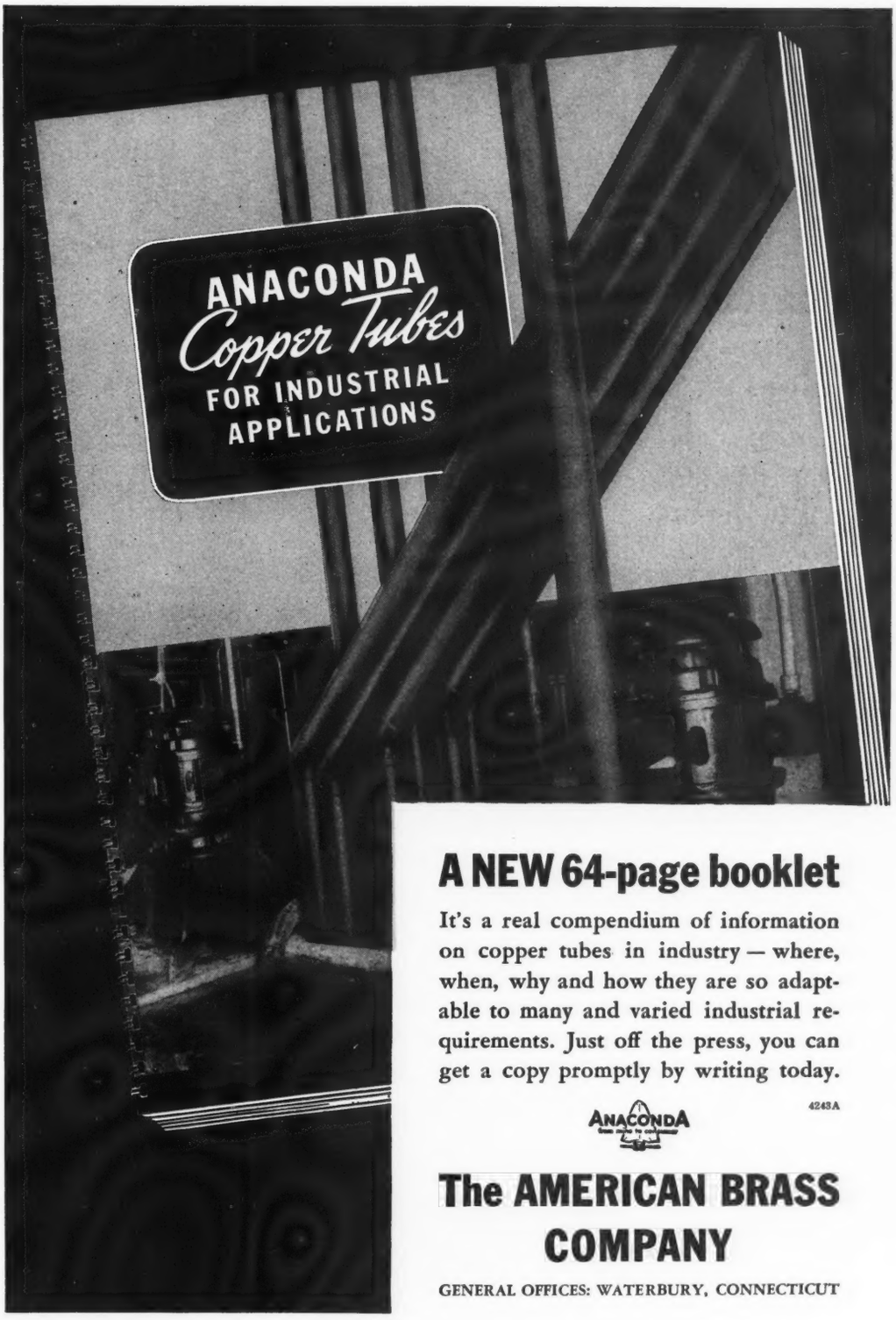
The secondary-network system has its load-center units permanently interconnected by low-tension tie circuits. Emergency power for a particular load center is obtained from adjacent stations on either side supplied from different primary feeders. This system requires only a moderate reserve transformer capacity but involves additional investment in low-tension tie circuits.

High Service Reliability

The secondary-network system allows better use of the transformers when it is necessary to shift load from a high- to a low-density area, but the low-tension tie circuits must be large enough to transfer the power. Service reliability is high, but has a correspondingly higher first cost, approximately 175% of the simple radial system, caused largely by added low-tension switching equipment together with the investment in low-tension tie circuits.

Operating simplicity is sacrificed. Any permanently interconnected system presents additional operating problems. Maintenance and adjustment of network protectors and relays requires considerably more skill than does maintenance of conventional air circuit breakers.

It is important to recognize that a particular electric circuit design depends for its reliability on the inherent reliability of the component parts. Unless equipment of comparable reliability is used there is no assurance of improved service reliability from a more complex system design. The relative standing of the several system with respect to the more important characteristics is summarized in Fig. 6. Of the several basic forms, the secondary selective system offers promise of widespread acceptance.



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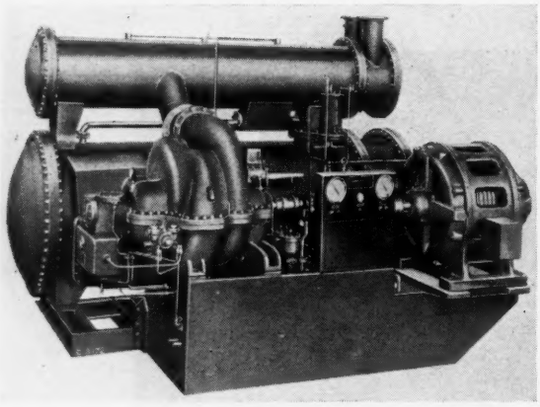
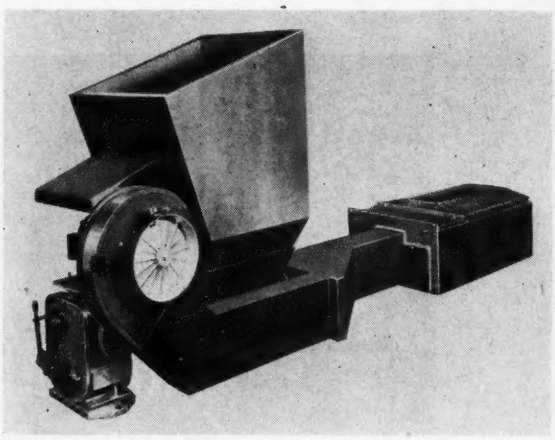




Liquid Cooling Systems

NEW LINE OF SYSTEMS is designed for air-conditioning and industrial process requirements. Centrifugal compressor is of the volute design, and units have many new features, such as dual lubrication, balancing of end thrust and side thrust by impeller arrangement, and others. Systems available in variety of sizes covering range from 150 to 1200 tons refrigerating effect. *Worthington Pump & Machinery Corp, Harrison, N. J.*

Tool Stand

PENCO TOOL STAND is designed for heavy-duty service with all-welded steel construction, 12-gage steel shelves and heavy angle legs. Drawers are 5 in. high, 18 in. wide, 15 in. deep, with a lock on each. *Penn Metal Corp of Pennsylvania, 36 Oregon, Philadelphia, Pa.*

Paint Selector

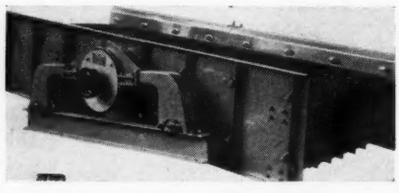
VALDURA PAINT SELECTOR is a handy means of selecting the best paint without detailed technical study of properties of all finishes that might be suitable for a given application. Selector makes available all information on properties of, and all application data necessary to choose properly from 43 paint, enamel and varnish products. Two charts are used in the Selector. 51 divisions on the first chart list all types of surfaces that might be encountered in industrial, commercial and residential painting, and under which are listed one or more paints suitable for the application. A second chart gives all properties of each paint to facilitate selection of the finish most suitable when a choice is offered by the first chart. Other information available includes a table of geometric equations, one showing light reflection values of standard colors, and tables to aid in estimating paint requirements for interiors and exteriors. *American-Marietta Co, 43 E Ohio St, Chicago, Ill.*

Pumps

COMPANY ANNOUNCES a 25-hp unit as an addition to its recently introduced Electrifugal pumps. Like other smaller units in the line, new pump is built as one unit, with both motor and pump on one shaft and in one housing. This is said to result in more perfect shaft alignment, less vibration, less wear, easier installation, and lower pumping cost. *Allis-Chalmers Mfg Co, Milwaukee, Wis.*

Vibrating Screen

STYLE M HIGH-SPEED unbalanced pulley-type vibrating screen will stand up to overloads, according to maker. The new screen has a number of features designed to save power, lubricant, screen cloth and general maintenance costs.



Oil-lubricated bearings are super-sealed by means of double-action flingers and welded splash and dust guards. Screen inclination, amplitude of vibration and operating speeds may be varied to obtain maximum flexibility. *Robins Conveying Belt Co, Passaic, N. J.*

Underfeed Stoker

REDESIGNED LINE OF COMPANY STOKERS includes hopper and bin-feed models, with clinker type burners (illustrated), or with side dumping grates. Units equipped with 3-speed heavy-duty automotive transmissions, oversized motors and fans. Totally enclosed windboxes and stoker fronts provided to assure air-tight air chambers and to eliminate much installation expense. Two doors in stoker front provide for positive windbox cleanout. *Frederick Iron & Steel Co, Frederick, Md.*

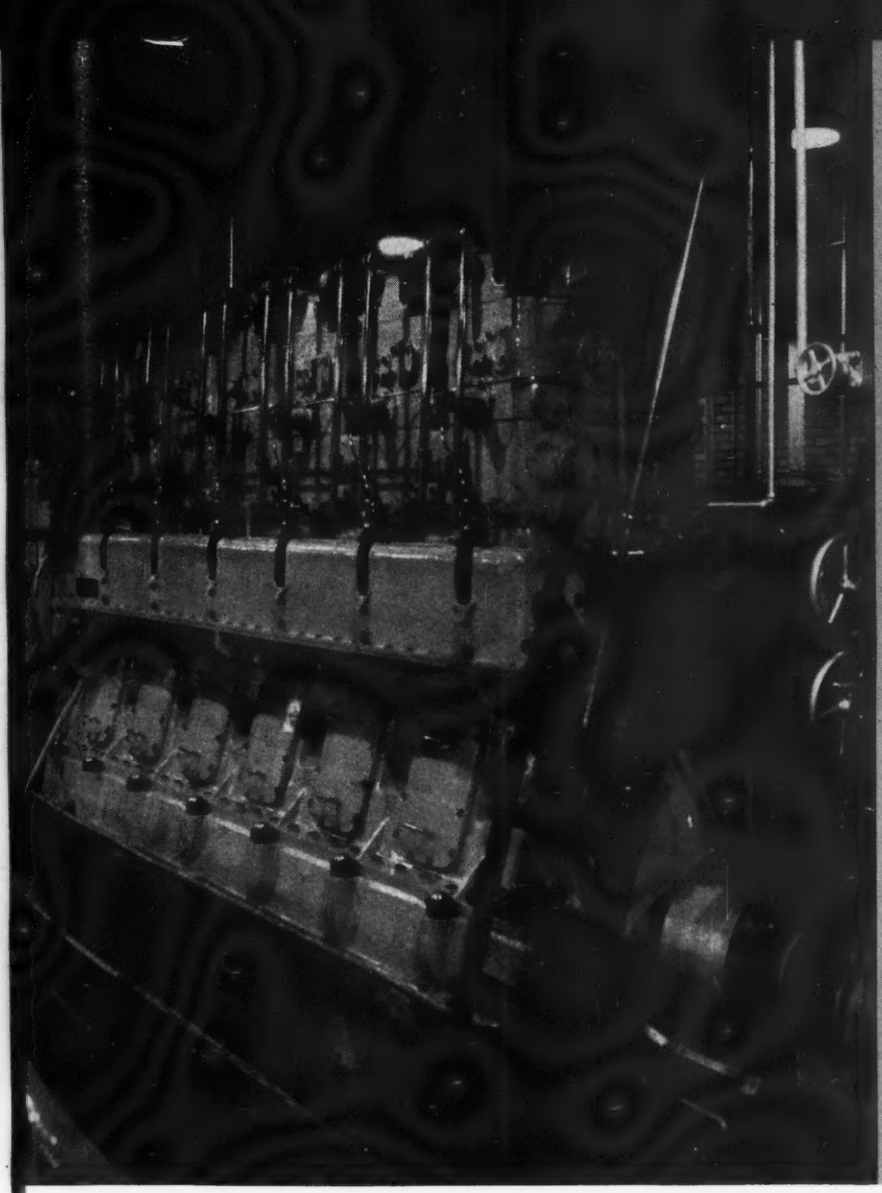
Floor Treatment

COLORFLEX-PLUS FLOOR TREATMENT cleans, colors and preserves floors—wood or concrete, new or old. Colorflex-Plus consists of a cleaner and dye-like coloring. The cleaner conditions the floors by removing dirt, grime and grease, and neutralizes the excess alkalinity in concrete, while the dye-like coloring forms perfect affinity with the floor. On concrete, it is said to eliminate sanding, dusting and powdering, preventing development of rough, worn, broken floors. On wood it is said to protect against splintering, cracking and scarring. *Flexrock Co, 2300 Manning St, Philadelphia, Pa.*

Rotary Pumps

COMPLETE LINE OF DIRECT-CONNECTED rotary pumps recently announced. Known as the "D-C" line, furnished in standard capacities of 5, 10, and 20 gpm, for pressures up to 100 psi. They will deliver rated capacity at operating speed of 1800 rpm. Standard units consist of pump mounted on bedplate with

(*Continued on page* 134)



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In operation 24 hours a day, 300 days a year for more than 10 years, two De La Vergne diesel engines in key plants of the Long Island Ice Corp. have operated more than 75,000 hours without a single forced shutdown.

Original pistons, cylinder liners, bearings, and inlet and exhaust valves are still in service. The entire cost of maintenance for the 10 year period for the Huntington, L. I., plant has been $164.01, that for the Smithtown, L. I., plant $173.32. A total for maintenance for the two De La Vergne 320-hp. diesels of $337.33. Only 5 cents per horsepower per year.

The two primary objectives in setting up these Long Island Ice Corp. plants were lowest possible operating costs and maximum dependability. Both requirements have been successfully met. Careful planning, sound plant layout, the best in diesels and a thorough inspection and service system have produced two outstanding cases of diesel engine economy and durability.

Baldwin De La Vergne SALES CORP.

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS

PHILADELPHIA

BLW THE BALDWIN GROUP

POWER LINES

New York—Detroit Turbines Go To Texas

A 45,000-kw 225-lb turbine from one of Detroit Edison's stations and a 40,000-kw 265-lb unit with six low-pressure boilers from Consolidated Edison's Hell Gate station, already on their way to a Texas magnesium plant, will enable operation of the latter within less than a year of date when first plans were drawn. The plant will be topped immediately by a 1250-lb duplicate of the Logan turbine.

Ingenious pairing of old but operable second-hand turbines and low-pressure boilers with a new turbine and high-pressure boilers is the result of co-operative effort between the War Production Board staff and engineers of the utility companies who contributed their services in accumulating the necessary equipment and preparing preliminary designs. Stone & Webster Engineering Corp is building the facilities for the Defense Plant Corp, and RFC subsidiary.

The low-pressure machines will be in service by July served by the six boilers from Hell Gate good for about 80,000 kw. Structural steel and some auxiliary equipment accompanies the old boilers. The two high-pressure boilers and topping turbines are scheduled for September delivery. A new condenser is being rushed for the Detroit low-pressure turbine.

Natural gas at less than five cents per thousand cubic feet and government interest rates on capital investment will enable power generation at an estimated three mills per kwhr. When the station is finished, three-fourths of the load and more than this proportion of the kwhr will be served by the new boilers and topping turbine including, of course, the power developed from the exhaust. The excess capacity of the low-pressure boilers will be held as reserve.

WPB power chief J A Krug has termed the installation not only absolutely reliable and consistent with practice in many of the best power-systems, but also one of the most efficient generating stations in the southwestern states.

"Buy Coal Now" Coordinator Urges

In a special communication to the editor of POWER, operators of power plants and boiler rooms everywhere are urged to buy and store coal immediately to avoid transportation difficulties later in the year. The warning comes from Howard Gray, acting director, Office of Solid Fuels Coordination, Department of the Interior, Washington, D. C. His message follows:

"I should like to request your co-operation in communicating to coal consumers who read your magazine the urgent recommendation of the Office of Solid Fuels Coordination that they use the surplus production and transportation capacity now available to store coal as insurance against possible shortages.

"The hand-to-mouth buying policy which many consumers followed prior to Pearl Harbor, instead of carrying adequate reserves in stock, is a dangerous practice during a war such as this one. Although there is no coal shortage now, the full force of the war and its repercussions have not yet been felt.

"The nation will require a great deal more coal in 1942 than it did in 1941, and there are indications that the war

(*Continued on page* 178)

ENGINEERS' BOOKSHELF

Service Manual

OIL BURNER SERVICE MANUAL (1942). *By Kalman Steiner and Fred Ravensbeck. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 365 pages, 6 x 9 in., illustrated, cloth cover. Price $4.*

A practical service manual covering both industrial and domestic oil-burning equipment and control by the author of "Oil Burners" and the chief engineer of Ace Engineering Co, Chicago. It gives the oil-burner mechanic the precise information he needs in time of trouble. Theory and practice of oil burning are covered as well as troubleshooting. The language is simple; ideas presented can be readily grasped from the well-illustrated text.

After describing pressure-atomizing, vertical-cup, rotary wall-flame and miscellaneous domestic burners the text proceeds to industrial rotary and atomizing units. Details of auxiliary apparatus, firebox construction, tanks and piping cover design as well as maintenance. Separate chapters explain the details of usual relays, circuits and automatic controls. Another chapter on draft and control, efficiency and testing should be part of the knowledge of every operator and serviceman.

Standards

ASTM STANDARDS—1941 SUPPLEMENT. *Published by American Society for Testing Materials, 260 South Broad St, Philadelphia, Pa. Three cloth-bound volumes, 6 x 9 in., to match the triennial book of standards. Includes correction stickers for inclusion in previous books. Price, any one part, $3, any two $5, three $7.*

To keep up to date, ASTM issues annual supplements to the Book of Standards. These three volumes give latest approved form of 370 specifications, tests and definitions either issued for the first time in 1941 or revised.

Part I on metals, with 126 standards, has 619 pages covering iron, steel, aluminum, aluminum alloys, magnesium, magnesium alloys, copper, lead, other alloys and two general testing methods.

Part II includes 125 standards, 449 pages, covering non-metallic materials used for constructional purposes. Specifications and tests cover cement, gypsum, refractories, glass, concrete, etc.

Part III, 663 pages, covers coal, coke, petroleum products, lubricants, electrical insulating materials, plastics, rubber products, textiles, paper.

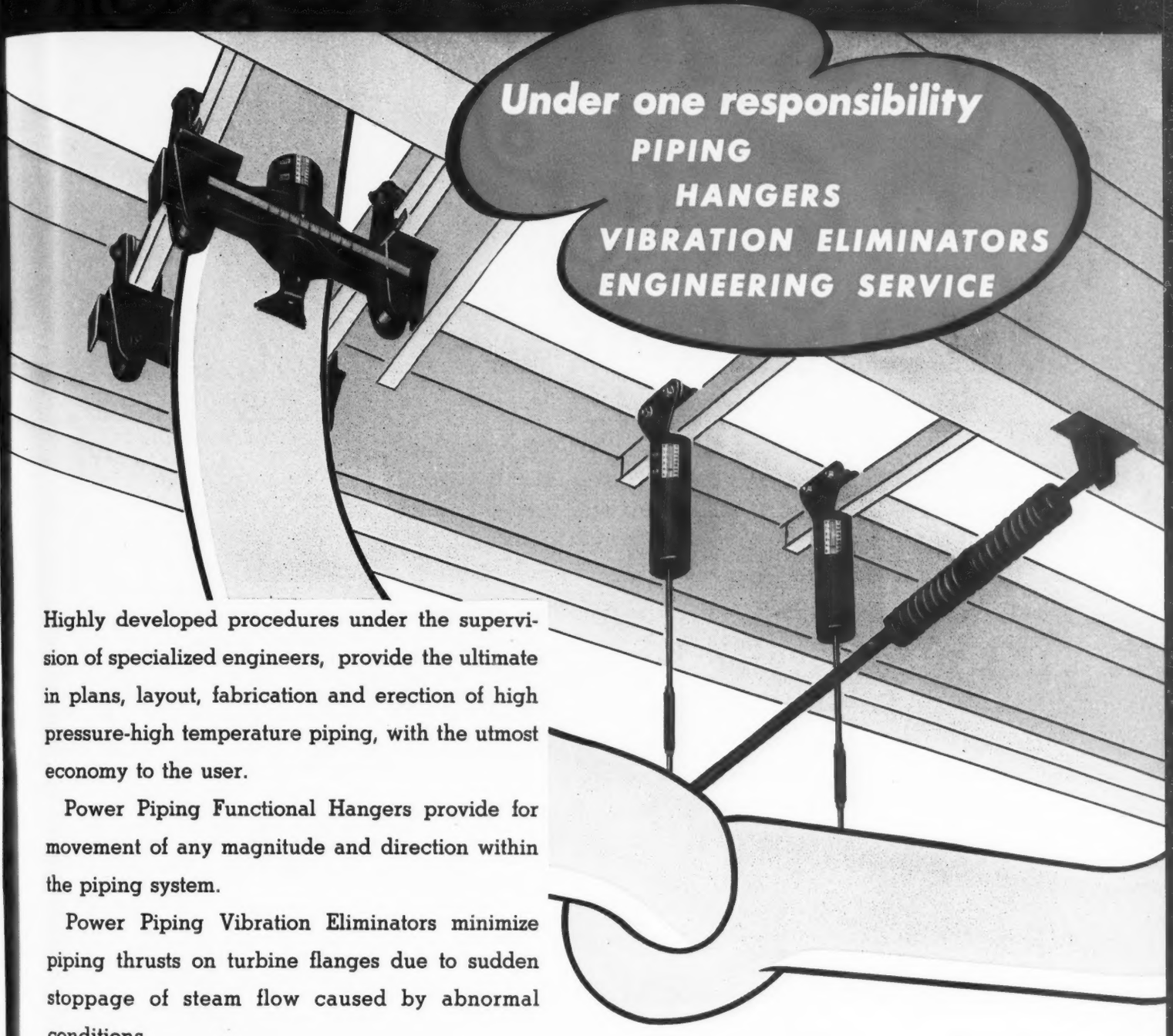
Piping

DESIGN OF PIPING SYSTEMS (1941). *Copyright by M W Kellogg Co, 225 Broadway, New York, N. Y. 8 x 11 in., illustrated.*

A highly technical and exhaustive

(*Continued on page* 174)

A PERFECT SYSTEM FOR FLEXIBILITY IN POWER PIPING INSTALLATIONS



Highly developed procedures under the supervision of specialized engineers, provide the ultimate in plans, layout, fabrication and erection of high pressure-high temperature piping, with the utmost economy to the user.

Power Piping Functional Hangers provide for movement of any magnitude and direction within the piping system.

Power Piping Vibration Eliminators minimize piping thrusts on turbine flanges due to sudden stoppage of steam flow caused by abnormal conditions.

Public Utilities are standardizing on Functional Hangers and Vibration Eliminators because they increase the life of the entire installation, eliminate repetition of stress and generally function as insurance to minimize operating hazards in high pressure piping systems.

On receipt of sketch or prints showing any piping system, we will gladly recommend the proper hanger and vibration eliminator layout without obligation.

A copy of "Flex-Anal Charts" will be sent to any engineer asking for it on his business letterhead.

•

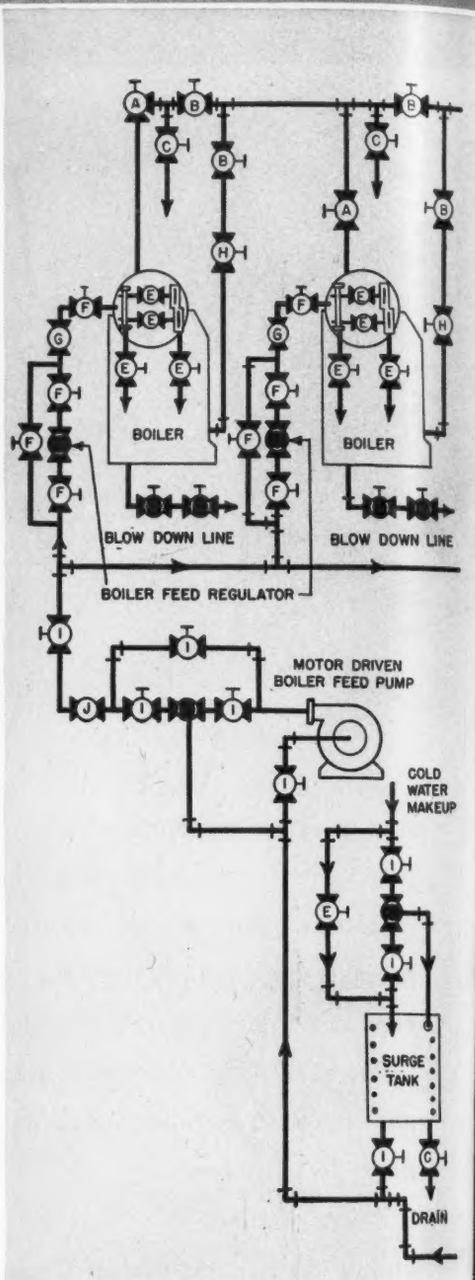
Send for Bulletin entitled Power Piping Functional Hangers and Vibration Eliminators.

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

FROM GOOD VALVE DESIGN...

REG. U.S. PAT. OFF.
TRADE JENKINS MARK
Jenkins Bros

An Economical CONDENSER HOOK-UP...



This diagram shows a typical condensing steam engine hookup, useful where there is no particular need for exhaust steam in processing or other plant operations. In spite of the fact that all essential equipment has been included, it is simple in design – the simplest possible type of condensing plant.

The necessary cooling water is supplied. A surge tank is installed to receive makeup and smooth variations in volume of condensate. Motor-driven auxiliaries promote simplicity and efficiency; in a single-unit system, they require an outside power source for starting-up.

The unit as shown will generate power at the lowest possible cost. The incorporation of a condenser reduces makeup needs to a mere 2%-5% of steam flow. In addition, it can decrease the steam consumption of the engine or turbine by 25%-50%.

You can match *plant* economy with *valve* economy by specifying Jenkins Valves. Because, dollar for dollar, Jenkins Valves will give you longer life and greater dependability at lower maintenance cost.

TYPICAL JENKINS VALVES USED IN THIS HOOK-UP

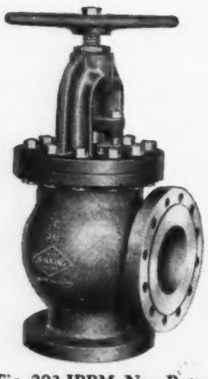


Fig. 293 IBBM Non-Return Automatic Equalizing Stop and Check

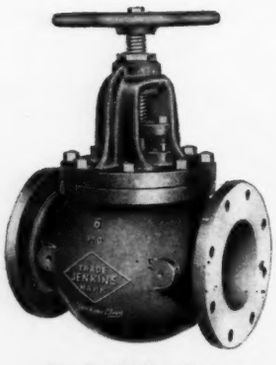


Fig. 142 IBBM Globe Renewable Composition Disc

Fig. 295 IBBM Swing Check Renewable Composition Disc

Fig. 962 Bronze Swing Check Regrinding Bronze Disc

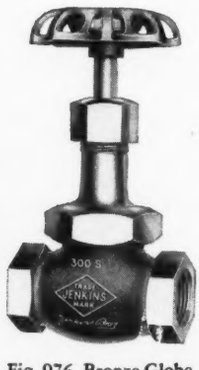
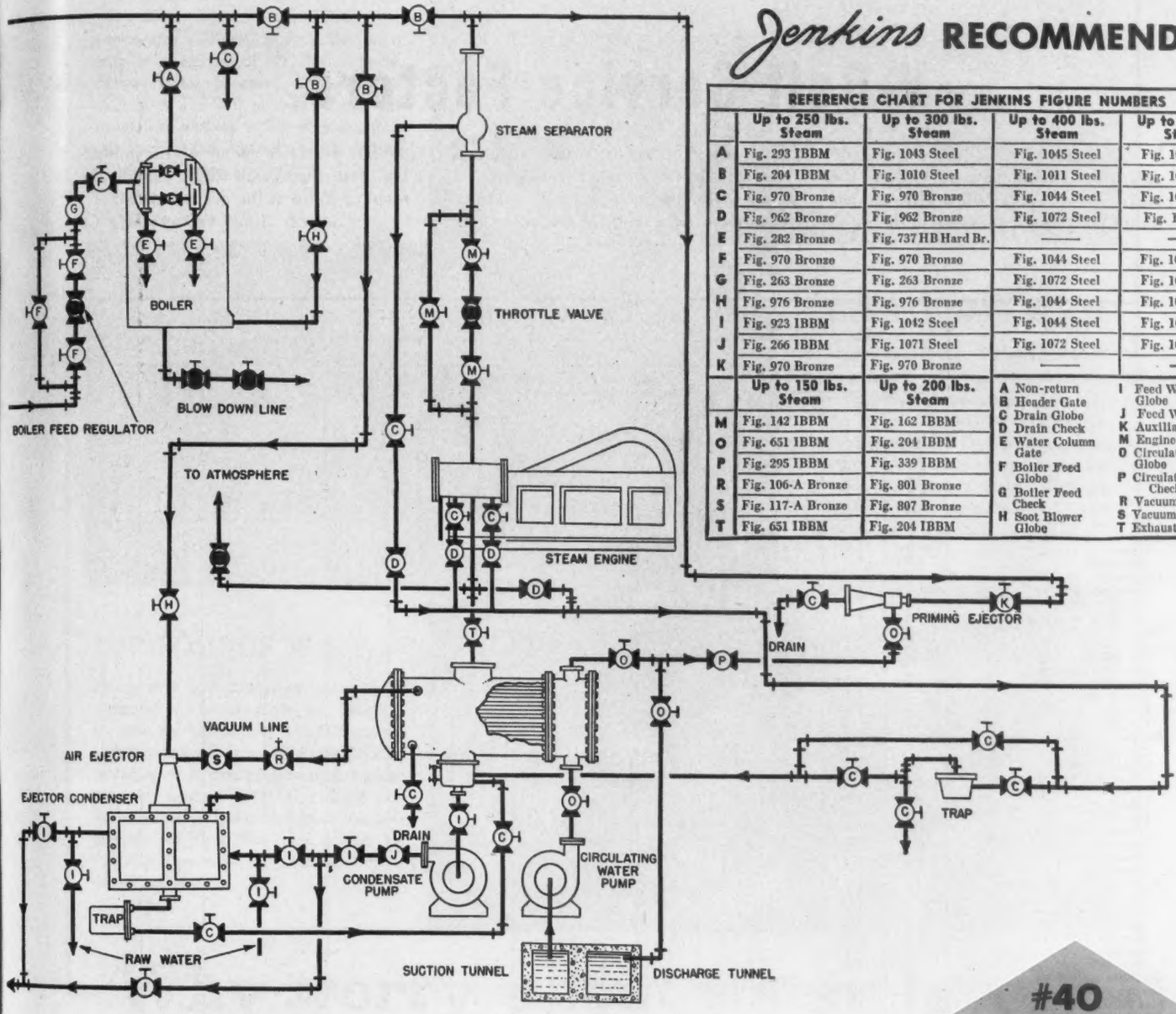


Fig. 976 Bronze Globe Stainless Steel Plug and Seat

JENKINS VALVES for every need

TO GOOD VALVE *PRACTICE*



Jenkins RECOMMENDS...

REFERENCE CHART FOR JENKINS FIGURE NUMBERS				
	Up to 250 lbs. Steam	Up to 300 lbs. Steam	Up to 400 lbs. Steam	Up to 600 lbs. Steam
A	Fig. 293 IBBM	Fig. 1043 Steel	Fig. 1045 Steel	Fig. 1047 Steel
B	Fig. 204 IBBM	Fig. 1010 Steel	Fig. 1011 Steel	Fig. 1012 Steel
C	Fig. 970 Bronze	Fig. 970 Bronze	Fig. 1044 Steel	Fig. 1046 Steel
D	Fig. 962 Bronze	Fig. 962 Bronze	Fig. 1072 Steel	Fig. 1073 Steel
E	Fig. 282 Bronze	Fig. 737 HB Hard Br.	—	—
F	Fig. 970 Bronze	Fig. 970 Bronze	Fig. 1044 Steel	Fig. 1046 Steel
G	Fig. 263 Bronze	Fig. 263 Bronze	Fig. 1072 Steel	Fig. 1073 Steel
H	Fig. 976 Bronze	Fig. 976 Bronze	Fig. 1044 Steel	Fig. 1046 Steel
I	Fig. 923 IBBM	Fig. 1042 Steel	Fig. 1044 Steel	Fig. 1046 Steel
J	Fig. 266 IBBM	Fig. 1071 Steel	Fig. 1072 Steel	Fig. 1073 Steel
K	Fig. 970 Bronze	Fig. 970 Bronze	—	—
	Up to 150 lbs. Steam	**Up to 200 lbs. Steam**		
M	Fig. 142 IBBM	Fig. 162 IBBM		
O	Fig. 651 IBBM	Fig. 204 IBBM		
P	Fig. 295 IBBM	Fig. 339 IBBM		
R	Fig. 106-A Bronze	Fig. 801 Bronze		
S	Fig. 117-A Bronze	Fig. 807 Bronze		
T	Fig. 651 IBBM	Fig. 204 IBBM		

A Non-return
B Header Gate
C Drain Globe
D Drain Check
E Water Column Gate
F Boiler Feed Globe
G Boiler Feed Check
H Soot Blower Globe
I Feed Water Globe
J Feed Water Check
K Auxiliary Globe
M Engine Globe
O Circulating Water Globe
P Circulating Water Check
R Vacuum Globe
S Vacuum Check
T Exhaust Gate

#40 OF A SERIES designed to help in selecting **JENKINS VALVES**

JENKINS Bronze, Iron, Steel Valves to meet every need

A glance through the Jenkins Catalog shows that you can specify "Jenkins" for practically every phase of commercial, industrial, engineering and plumbing and heating needs. The line of over 600 valves includes:

Iron, Bronze, Cast Steel and Corrosion-resisting-alloy Gate, Globe, Angle, Cross, Y and Check valves... with composition, bronze, nickel alloy, iron and steel disc or plug... in solid wedge, split wedge, double disc-parallel seat and double disc-taper seat types... in inside screw and OS&Y patterns... with non-rising, traveling, rising and sliding spindle... conventional, quick-opening and rapid action... with screw-in, screw-over, union and bolted bonnet... with screw, flanged, union and solder ends... to meet Underwriters', AWWA, ASME and Marine specifications... in sizes 1/8" to 36"... for pressures from 125 to 600 pounds... for steam, air, oil, water, gas, chemicals, solvents and other fluids.

All are made to the standard of quality which has given Jenkins Valves the reputation of being "cheaper in the long run". Yet, with two exceptions, they cost no more to buy than other good valves.

AVAILABLE THROUGH GOOD SUPPLY HOUSES EVERYWHERE

JENKINS BROS., 80 White St., New York, N. Y.; Bridgeport, Boston, Atlanta, Philadelphia, Chicago, Houston. Jenkins Bros., Limited, Montreal, Canada; London, England.

REG. U.S. PAT. OFF. TRADE JENKINS MARK *Jenkins Bros*

d Built Better but PRICED NO HIGHER

Number 115

V-Belt Service Factors

▶ WHEN SELECTING V-belt drives, consider the driving unit as well as the service load. Table below gives proper multiplying factor to apply to the rated horsepower of the drive unit to obtain correct size of V-belt. For example, a single-cylinder reciprocating compressor driven by a 50-hp synchronous motor has a service factor of 1.5 indicating that the V-belt drive should be rated at 75 hp at the desired speed.

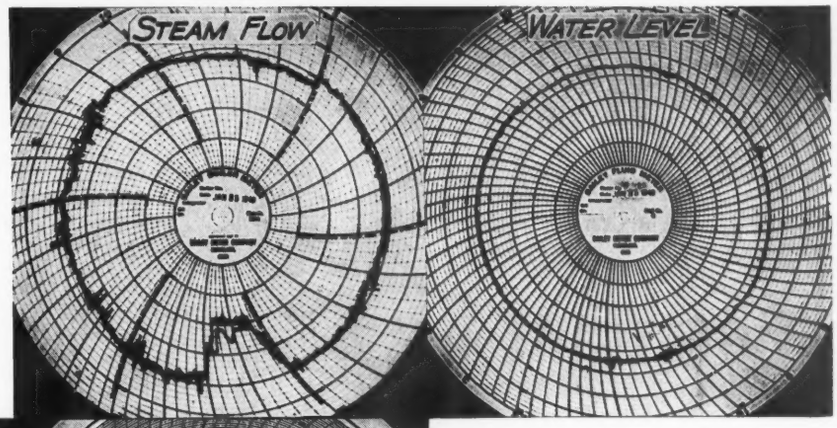
Courtesy Allis-Chalmers Mfg Co

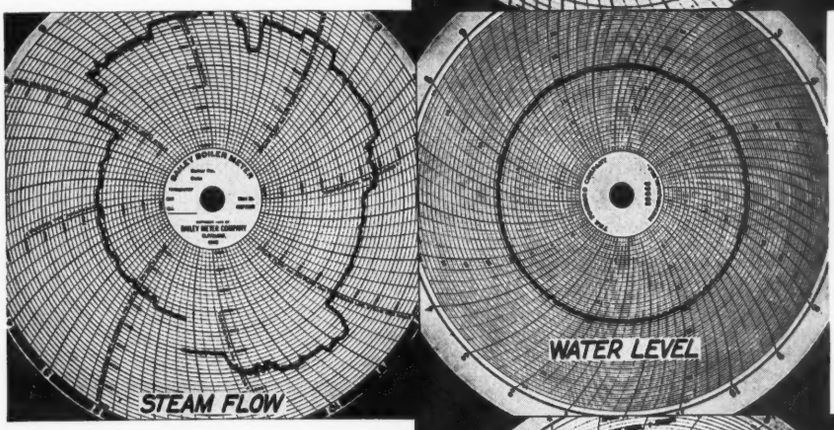
Application	*Electric motors*										*Engines*			
	AC								*DC*		*Gas and Diesel*			
	Squirrel cage				*Synchronous*		*Single phase*							
	Normal torque Line start	*Normal torque compensator start*	*High torque*	*Wound rotor (slip-ring)*	*Normal torque*	*High torque*	*Repulsion and split-phase*	*Capacitor*	*Shunt wound*	*Compound wound*	*4 or more cyl above 700 rpm*	*4 or more cyl Below 700 rpm*	*Steam*	*Line shafts and clutch starting*
Agitators — (paddle-propeller)														
Liquid	1.0	1.0	1.0	...	...	...	...	...	...	...	...	...	...	...
Semi-liquid	1.2	1.0	1.4	1.2	...	...	...	...	...	...	...	...	...	...
Compressors														
Centrifugal, rotary	1.2	1.2	...	1.4	1.4	...	1.2	1.2	1.2	...	1.2	...	...	...
Reciprocating — 3 or more cyl	1.2	1.2	...	1.4	1.4	...	...	...	1.2	...	...	...	...	...
1 or 2 cyl	1.4	1.4	...	1.5	1.5	...	...	...	1.2	...	...	...	...	...
Conveyors														
Apron	...	1.4	1.6	...	...	...	...	...	1.4	...	...	...	...	1.6
Belt (ore, coal, sand)	...	1.2	1.4	...	...	...	...	...	1.2	...	...	...	...	1.4
Belt (light package)	...	1.0	1.1	...	...	...	...	...	1.0	...	...	...	...	1.2
Screw	...	1.6	1.8	...	...	...	...	...	1.6	...	...	...	...	1.8
Bucket, pan	...	1.4	1.6	...	...	...	...	...	1.4	...	...	...	...	1.6
Flight	...	1.6	1.8	...	...	...	...	...	1.6	...	...	...	...	1.8
Elevator	...	1.4	1.6	...	...	...	...	...	1.4	...	...	...	...	1.6
Crushing machinery														
Jaw crushers	...	1.4	1.6	1.4	...	...	...	...	...	1.4	1.4	...	...	1.6
Gyratory crushers	...	1.4	1.6	1.4	1.4	1.6	...	...	...	1.4	1.4	...	...	1.6
Ball — pebble and tube mills	...	1.4	1.6	1.4	1.4	1.6	...	...	...	1.4	1.6	...	...	1.6
Fans and Blowers														
Centrifugal	1.2	1.2	...	1.4	...	...	...	...	1.2	...	1.2	...	...	...
Propeller	1.4	1.4	2.0	1.6	...	2.0	...	...	1.4	...	1.4	...	...	...
Induced draft	1.2	1.2	...	1.4	...	...	...	...	1.4	...	1.4	...	...	...
Mine fans	1.6	1.4	2.0	...	...	2.0	...	...	...	...	1.6	...	...	...
Positive blowers	1.6	1.6	...	2.0	2.0	2.0	...	...	...	...	1.6	...	...	...
Exhausters	1.2	1.2	...	1.4	...	...	...	...	1.4	...	...	...	1.5	1.5
Flour-Feed-Cereal Machinery														
Bolters and sifters	...	1.0	...	...	...	...	...	...	...	...	...	...	...	...
Grinders and hammermills	...	1.4	...	...	...	...	...	...	...	...	1.6	...	...	...
Purifiers and reels	1.2	1.4	...	...	...	...	...	...	...	...	...	...	...	...
Main-line shaft drives	1.4	1.4	1.6	1.4	1.4	...	...	...	...	...	1.8	...	...	...
Separator	1.0	1.0	...	...	...	...	...	...	...	...	...	...	...	...
Roller mills	...	1.4	...	...	...	...	...	...	...	...	...	...	...	...
Generators and Exciters	1.2	...	...	...	...	...	...	...	1.2	...	2.0	...	1.4	1.4
Laundry machinery	1.2	...	...	...	...	...	...	...	...	1.2	...	...	...	...
Line shafts	1.4	1.4	...	1.4	1.4	2.0	1.4	1.4	1.4	1.4	1.6	...	1.6	1.6
Machine tools														
Grinders, boring mills	1.2	...	...	1.4	...	...	1.2	1.0	1.2	1.2	...	...	...	...
Lathes	1.0	...	...	1.2	...	...	1.0	1.0	1.0	1.0	...	...	...	...
Milling machines	1.2	...	...	1.4	...	...	...	...	1.2	1.2	...	...	...	...
Screw machines, cam cutters	1.0	...	...	1.0	...	...	1.0	1.0	1.0	1.0	...	...	...	...
Planers	1.2	...	...	1.4	...	...	1.2	1.0	1.2	1.2	...	...	...	...
Shapers, drill press	1.0	...	...	1.0	...	...	1.0	1.0	1.0	1.0	...	...	...	...
Drop hammers	1.0	...	...	1.0	...	...	1.0	1.0	1.0	1.0	...	...	...	...
Shears	1.2	...	...	1.4	...	...	1.2	1.2	1.2	1.0	...	...	...	...
Mills														
Pebble, rod, ball, roller mills	...	1.4	1.6	1.4	...	...	...	...	...	1.4	...	...	...	1.6
Oil-field machinery														
Slush pumps	...	...	...	...	...	...	...	...	1.4	...	1.4	1.6	1.4	1.4
Pumps	1.2	1.2	1.4	...	...	...	...	...	1.4	...	...	...	...	1.6
Paper machinery														
Jordan engines	1.5	1.3	1.8	1.5	1.6	1.8	...	...	1.5	1.5	...	...	...	...
Beaters	1.4	1.4	...	1.4	...	...	...	...	1.4	1.4	...	...	...	1.8
Calenders	1.2	1.2	...	1.2	...	...	...	...	1.2	1.2	...	...	...	...
Agitators	1.2	1.0	1.4	1.2	...	...	...	...	1.2	1.2	...	...	...	1.6
Dryers	1.2	1.2	...	1.2	...	...	...	...	1.2	1.2	...	...	...	...
Paper machines	1.4	1.4	...	1.5	...	...	...	...	1.5	1.5	...	...	...	1.6
Pumps														
Centrifugal, gear	1.2	1.2	1.4	1.4	...	...	1.2	1.2	...	...	...	...	...	...
Rotary	1.2	1.2	1.4	1.4	...	...	1.2	1.2	1.2	...	1.2	...	...	...
Reciprocating — 3 or more cyl	1.2	1.2	...	1.4	1.4	1.6	...	...	...	...	1.8	...	1.8	...
1 or 2 cyl	1.4	1.4	...	1.6	1.6	1.8	...	...	...	...	2.0	...	2.0	...
Rubber-plant machinery	1.4	1.4	1.4	1.4	...	1.8	...	...	...	...	...	...	2.0	...
Screens, vibrating, conical, revolving	1.2	1.2	1.4	...	...	...	...	...	...	...	...	...	...	...
Textile machinery														
Spinning frames, twisters	1.6	...	1.8	...	...	...	...	...	...	...	...	...	...	...
Looms, warpers, reels	1.2	...	...	...	...	...	...	...	...	...	...	...	...	...

© POWER

1300 POUNDS W.S.P.—

Fired with pulverized coal or oil, this 1300-pound B. & W. boiler in a prominent Eastern utility plant normally evaporates 275,000 pounds per hour with a maximum of 300,000 pounds. Excess water pressure at pump discharge is 250-300 pounds. The boiler water level is held within plus or minus one inch of the desired normal by the COPES Flowmatic Regulator.



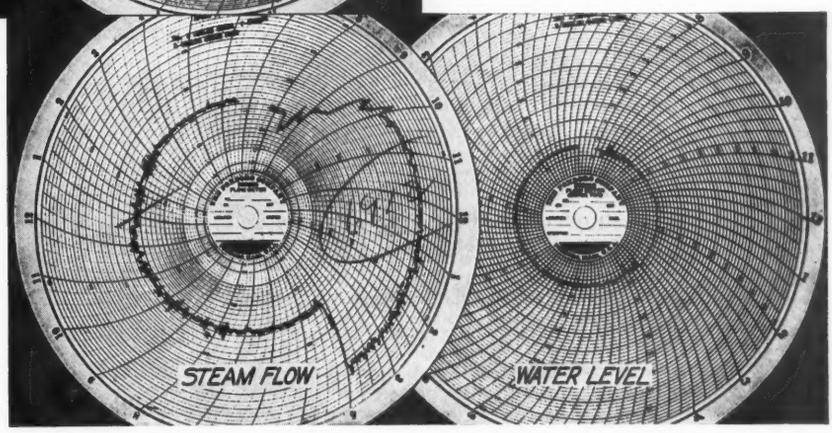


—875 POUNDS W.S.P.

Powdered coal firing. 875-pound, 860-degree, Foster Wheeler 3-drum boiler. The maximum evaporation with this utility boiler is 400,000 pounds per hour; normal, 330,000 pounds per hour. The motor-driven centrifugal pump has no automatic pressure control. Extreme water level range permitted by COPES Flowmatic is 1.6 inches.

600 POUNDS W.S.P.—

Firing with acid sludge or gas, normal evaporation is as high as 350,000 pounds per hour on this 600-pound pressure Riley Steam Generator. Boiler water level is carried one inch higher at peak load of 360,000 pounds per hour than at normal minimum of 242,000 pounds per hour. The level control by COPES Flowmatic is unusually close on all loads.



Why worry about water level?

The COPES Flowmatic is daily demonstrating close level control at pressures from 80 to 1325 pounds—for capacities up to 550,000 pounds per hour. Write for Bulletin 429, showing typical charts and explaining operation.

NORTHERN EQUIPMENT CO., 321 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

★ GET CLOSER LEVEL CONTROL WITH THE FLOWMATIC ★ REGULATOR

For Want of a Nail . . . .

The other day I was talking to a man who sells power equipment. He spoke of present times—of the war and of priorities. He told me of three recent cases. Each makes its own point. Even though the end of the OPM will probably throw priorities out the window, the same conditions are just as possible and as likely under any new set-up. Here are the stories:

1. Two manufacturers ordered turbines, one on higher priority than the other. The top-priority turbine was rushed through and delivered—to stand idle for a couple of months while the plant was made ready. The lower-priority turbine was shipped just that much late—to a user who had had to hold up vital production until its arrival.

2. A manufacturer ordered replacement parts for stokers—backed by high priority. But the order was so large that the maker checked up—to find that the replacements would meet that customer's needs for *twenty* years. He was just "being prepared."

3. A desperate plea for replacement parts came in from a plant that had broken down. The builder checked to find why no priority had been given—and found that the user didn't think he was entitled to one, even though over a quarter of his production was defense!

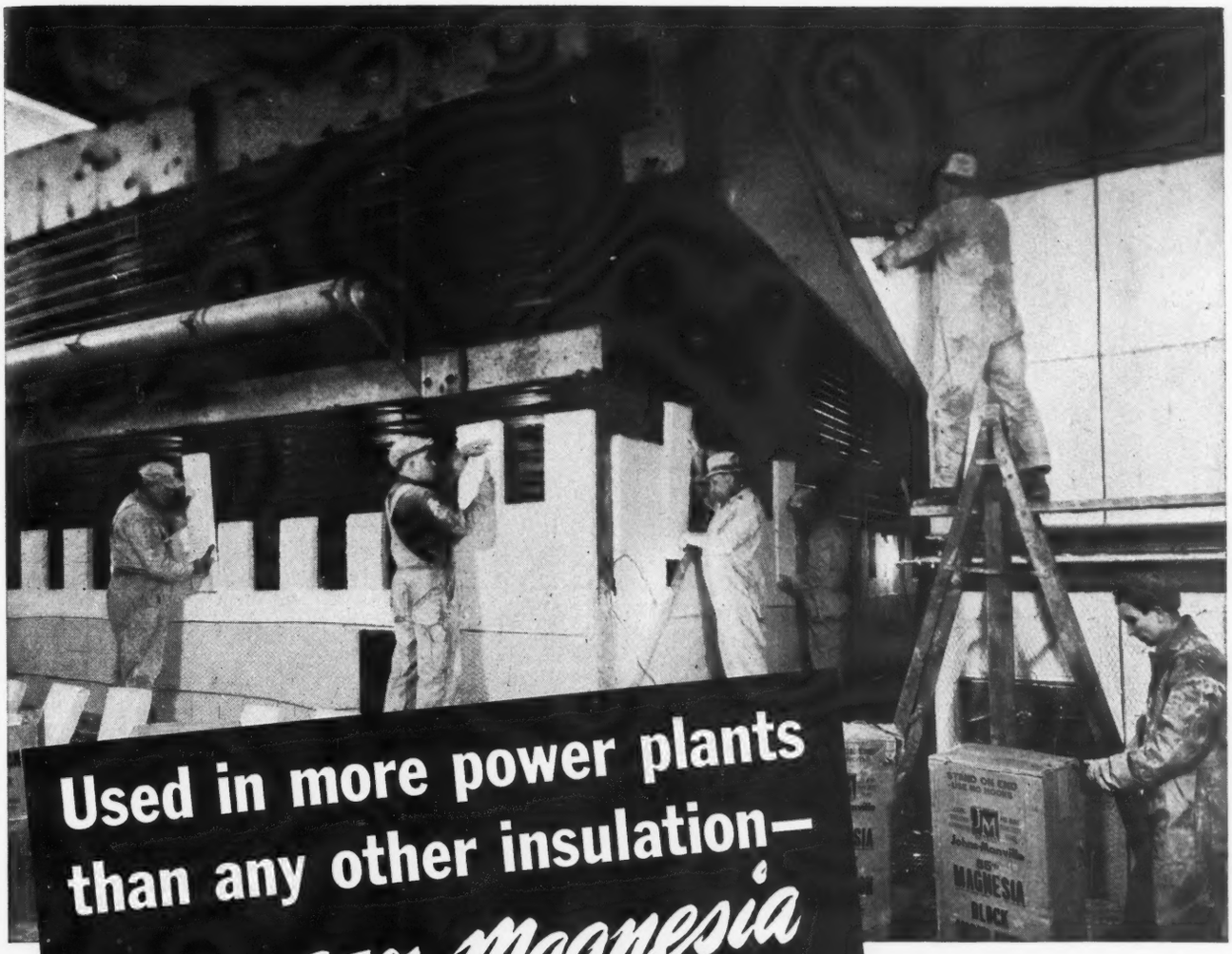
Other high-priority orders for equipment have included every accessory shown in the catalog, or an entire set of tools. Checkup often shows that only a couple of the accessories or a few sizes of tools are needed—but the buyer says he ordered all because he may "need them for changeover some time." Other buyers insist on delivery "right now" of an entire order—when they could take part of it now and other parts at later dates.

These are all "little" things. Singly they don't matter. But taken all together, they remind me of that old saying, "For want of a nail, the shoe was lost; for want of a shoe, the horse was lost; for want of a horse, the king was lost, and for want of a king, the kingdom was lost."

I am sure that if we all keep thinking how each little "bleed" of equipment or supplies from the basic job can help to jeopardize the whole Victory program, we will all do our level best to make sure that it *doesn't* happen here. France set a terrible example of the results of "every-man-for-himself" thinking.

George Edwards

Engineer



Used in more power plants than any other insulation—

J-M 85% Magnesia

For power-plant service up to 600°, it's a habit with engineers to specify J-M 85% Magnesia Blocks and Pipe Insulation.

It's a good habit, too, they'll tell you, for no other material provides such satisfactory performance on the job. That's because J-M 85% Magnesia delivers the right combination of long life and high insulating value that means *permanently* efficient, economical service.

And it's easy to install, for it is light in weight, readily cut and fitted. For details, write Johns-Manville, 22 East 40th St., New York, N. Y.

A Few Other J-M Insulating Materials

For cold rooms, ducts and refrigerating equipment—
Rock Cork Sheets

For refrigerated piping—
Rock Cork Pipe Insulation

For cold-water lines—
Anti-Sweat Pipe Insulation

For hot or cold service-water lines—
Pre-Shrunk Wool Felt Pipe Insulation

For low-pressure steam lines—
Pre-Shrunk Asbestocel Pipe Insulation

For steam lines to 700° F.—
Asbesto-Sponge Felted Pipe Insulation

For superheated steam lines—
Superex-Magnesia Combination Insulation

For furnace insulation—
Superex Blocks, Insulating Brick (3 types), Insulating Fire Brick (4 types), Sil-O-Cel C-3 Concrete

Other insulations for special requirements

Johns-Manville INDUSTRIAL INSULATIONS

FOR EVERY TEMPERATURE . . . EVERY SERVICE CONDITION

Take Time to Test

Now is no time for electrical insulation failures that can tie up production. Wise maintenance programs regularly schedule brief "time-out" for testing the insulation of all important machines, cables and control equipment.

And of equal importance in many installations are measurements of ground connection resistances, for safety, and to avoid trouble due to lightning and other system disturbances.

Biddle Bulletins on Preventive Maintenance

- *Pocket Manual of "Megger" Practice No. 1420 P*
- *On the Use of Hand Driven "Megger" Testers, Bulletin 1655*
- *Ground Resistance Testing, Tech. Bulletin 1285*
- *"Ducter" Ohmmeter (used on Circuit Breakers) Bulletin 1635*

When writing, please mention this Advt. No charge.

The above picture is by courtesy of the Hartford Steam Boiler Inspection and Insurance Co. This and other large Insurance Companies protect their risks—and your plant—by systematic inspection and testing, in which our "Megger" Instruments play a fundamental part.

These remarkable testers, with self-contained hand-cranked generators, have served industry for more than 35 years. You make no mistake when you select them.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"MEGGER"
TRADE MARK REGISTERED U S. PAT OFF

Planetary Gears

(*Continued from page* 68)

in one direction and their shafts turn in another. Idler-bearing speed relation to its shaft is therefore not the rotational speed of the idler, but a higher value. This is found by the relation: idler-bearing speed relative to its shaft = output speed × (ring-gear teeth ÷ idler-gear teeth) = 300 × (100 ÷ 40) = 750 rpm.

Upper Ratio Limit

The upper limit of speed ratio is not the relative number of teeth of the mating gears, but the interference between idler gears, where three or more idlers are used. For a 3-idler planetary set the outside diameter of the idlers must be less than 0.866 × (sun-pinion pitch diameter + idler-gear pitch diameter). This limits the upper speed ratio to about 12.5:1. In this unit the idler gears have a pitch-circle diameter 5.25 times as large as that of the sun pinion; in other words, each idler has 5.25 times as many teeth as the pinion.

For a 4:1 speed ratio the idlers and sun pinion have the same number of teeth. In a planetary gear system with a speed ratio of 3:1 the sun pinion has twice as many teeth as each idler gear and the pinion idler part of the set acts as a speed increaser.

In such a unit if the sun pinion has 50 teeth, the idlers will have 25 teeth each and the ring gear 100 teeth. Then, if the input speed is 1750 rpm, output speed = 1750 ÷ [1 + (100 ÷ 50)] = 583 rpm. Idler speed = 583 × [1 − (100 ÷ 25)] = −1750 rpm, the same as the sun pinion. Idler-bearing speed relative to its shaft = 583 × (100 ÷ 25) = 2332 rpm.

Double-Reduction Unit

For a double-reduction unit, Fig. 3, the speed ratio for each reduction is calculated as for a single reduction and the two multiplied to get the total reduction. For example, if the speed ratio of the high-speed unit was 8:1 and the low-speed unit ratio 7:1, then the total speed reduction is 8 × 7 = 56:1. Idler speeds are calculated as for the single unit.

The foregoing analysis holds for the compound planetary system, except that the effects of the idler pinion must be taken into account. In such a system: output speed = input speed ÷ [1 + (ring-gear teeth × idler-gear teeth) ÷ (idler-pinion teeth × sun-

Internal corrosion of boilers is due largely to the presence of oxygen in the feed water, and in a smaller degree to acidity or dissolved carbon dioxide. Even after external treatment, these corrosive agents may still be present in damaging amounts. In the solution of corrosion problems Betz engineers depend upon no rule-of-thumb panacea; they first search for and find the cause, then apply the proper combination of corrective chemicals to prevent further destructive action.

Now, as never before, with all industry under the necessity of attaining the utmost in production with available plant and personnel, the matter of correct water conditioning becomes primary in importance. In this vital field Betz stands ready to render a complete service . . . of consultation, research and supervision.

Rem-Ox, Betz technical Sodium Sulfite for oxygen reduction is now available for prompt shipment. Write for information and prices.

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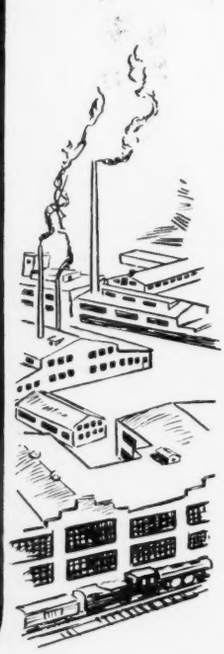
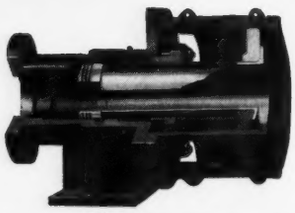


Whether you are working on defense contracts or regular production, you cannot afford costly shutdowns in your service lines.

Install ADSCO Piston-Ring Expansion Joints — the slip type joints that can be unpacked and repacked under full operating conditions without interruption to service.

Get all the facts about this modern expansion joint that's always on the job for America's largest industries — Ford — Chrysler — Consolidated Aircraft—U.S. Steel —Carnegie Steel—DuPont—Socony Vacuum—Sun Oil—Armstrong Cork and many others.

Write for quotations, also bulletin 35-15PR.



ADSCO PISTON-RING EXPANSION JOINT

for Steam, Hot Water, Oil or Gas Lines

Piston rings in internal guide hold line pressure during unpacking and repacking operations.

Fully guided by internal and external guide.

Available in single or double joints for high pressures and high temperatures; flanged or beveled ends.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA, N. Y.

Making "UP-TO-DATE" Steam Line Equipment for over 60 years

ADSCO PISTON RING JOINTS

Can Be Packed Under Pressure

pinion teeth)]. Idler speed relative to its housing = output speed × [1 − (ring-gear teeth ÷ idler-pinion teeth)], and, idler speed relative to its shaft = output speed × (ring-gear teeth ÷ idler-pinion teeth).

Gear Application

In the foregoing attention has been given to those features of planetary-gear systems that are of most interest to power and industrial engineers. There are others that are of interest chiefly to gear designers and manufacturers that will not be considered here. In a second article the application of planetary gears will be considered.

Argument Corner

(Continued from page 99)

probably coincidental as the boiler likely would have burst anyhow. There is a vast difference in the reaction of the quick closure of a steam valve and that of a water valve. Water is not compressible and its momentum will set up a series of waves (water hammer) sufficient to rupture a pipe or fitting; with steam this does not occur to anywhere near the same degree, as for example, the emergency trip on a turbine. Even in the old days automatic stops were often fitted to the throttle for shutting down the engine in case some one tangled with a belt or pulley, and these did not work exactly slow. Anyhow the moral was good.

Melrose, Mass. E MACDERMOD

Finding Engine Speed

THE QUESTION ASKED IN THE NOVEMBER issue of POWER on how to find the speed of an engine is not a trick question.

On engines using a throttling governor the governor speed is stamped on the frame of the governor itself.

To find the engine speed multiply this number of the diameter of the governor pulley and divide the product by the diameter of the governor belt pulley on the engine shaft. This quotient will equal the engine speed.

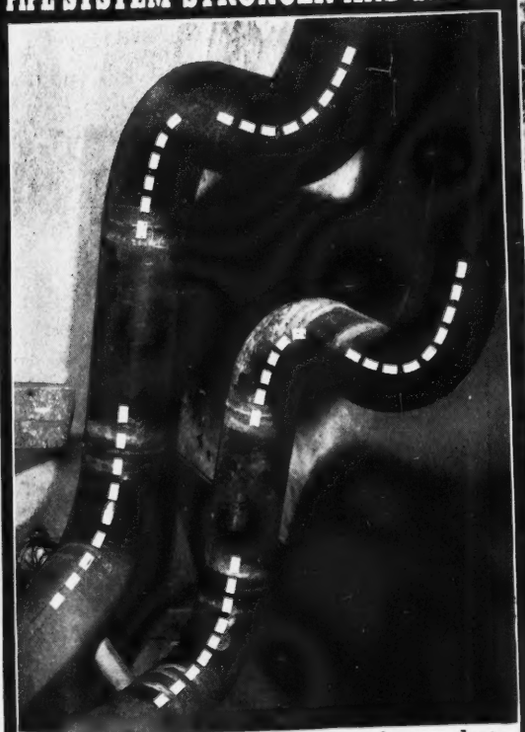
This method, while suitable for throttling governors, cannot be used with shaft governors as in this case the operating speed is not stamped on the governor frame.

Port Huron, Mich. E PAFINEAU

...Taking the curves FAST is equally treacherous in piping!

THE DANGER LIES AT THE TURNS

TUBE-TURN FITTINGS MAKE EVERY PIPE SYSTEM STRONGER AND SAFER



When pipe lines snake their way thru a plant like these chemical lines, forming neat, compact layouts, it's little wonder engineers insist on TUBE-TURN fittings. There are no flanges to tighten, no gaskets to replace—no chance of dangerous leakage. The turns indicated above —*where the danger lies*—are strong and safe—fully protected with TUBE-TURN welding fittings.

There's less flow resistance and pressure loss when you use Tube-Turn welding fittings

A flashing glide down the mountain side into a splendidly executed *Kristiana*—a sweeping turn at full speed that scarcely slows the skier! It's the same kind of uninterrupted flow that engineers desire in piping—and TUBE-TURN welding elbows and returns assure minimum resistance, thanks to the easy sweeping radius throughout. TUBE-TURN fittings' smooth inner walls are free from waves, scales or ridges which often accelerate corrosion and erosion. TUBE-TURN fittings give *plus strength* where the danger lies—at the turns—wherever there is a change *in flow direction!* For safe, trouble-free piping systems, insist on TUBE-TURN welding fittings!

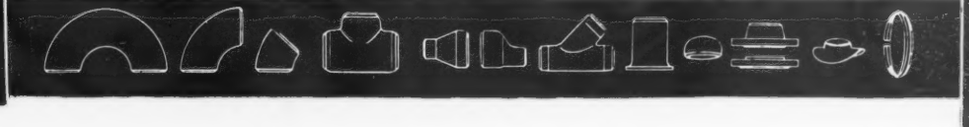
Write today for TUBE-TURN engineering data book and catalog.

TUBE-TURNS, Inc., Louisville, Ky. *Branch offices:* NEW YORK, PHILADELPHIA, CHICAGO, PITTSBURGH, CLEVELAND, TULSA, LOS ANGELES. *Distributors everywhere.*

TUBE-TURN TRADE MARK

The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

Welding Fittings



Completely Assembled for QUICK Installation

EC&M 2300 VOLT WOUND-ROTOR MOTOR STARTER

Close-up view showing EC&M NEO-TIME-CURRENT Unit for automatically controlling acceleration.

HERE is a new design EC&M Push-button-operated Motor Starter for 2300 Volt Wound-rotor Motor driving a Dixie Mill Crusher. Of unit-type, it is *complete in every respect*—with self-contained disconnect switches, secondary control panel and primary magnetic contactor entirely enclosed as a single unit.

Ready to be placed in position and connections easily made to the power leads and motor terminals, this unit-assembly *offers many advantages.* It quickens installation time. The installation is shock-proof yet readily accessible, when needed, through heavy-gauge, easy-operating enclosing doors. For adverse atmospheric conditions, doors may be gasketed to exclude dust or corrosive fumes.

As a companion to EC&M Unit-type Synchronous Motor Starters, this new design wound-rotor starter makes a complete line of EC&M totally enclosed starters. Ask for Booklet 67 showing typical examples of EC&M Completely Assembled *Steel-clad* Motor Control.

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CLEVELAND OHIO

● HEAVY DUTY MOTOR CONTROL ● BRAKES ● LIMIT STOPS ● WELD TIMERS ● LIFTING MAGNETS

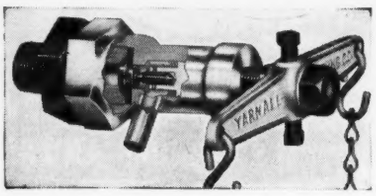
New Plant Equipment

(*Continued from page* 130)

flexible coupling for direct connection to an electric motor, steam turbine or gasoline engine. A high-lift, non-chatter relief valve is built as integral part of pump casing. The valve will bypass entire pump capacity without causing shock or end-thrust on the working parts of the pump. The pumps are self priming and positive displacement. They are suitable for suction lifts of 27 ft, provided the liquid does not vaporize under vacuum or pressure. They are not recommended for handling liquids having temperatures in excess of 250 F, but at lower temperatures will handle practically any clean liquid. *Blackmer Pump Co, Grand Rapids, Mich.*

Try Cock

ILLUSTRATION SHOWS YARWAY HEAVY-DUTY TRY COCK, built for high-pressure service. For pressures up to 600 lb. body and steam are tobin bronze, for 600 to 1500 lb, these parts are stainless



steel. To avoid interference of operating chains, operating lever on upper try cock is offset outward, lever on center unit is straight, and lever on lower try cock is offset inward. *Yarnall-Waring Co, Chestnut Hill, Philadelphia, Pa.*

Distribution Unit

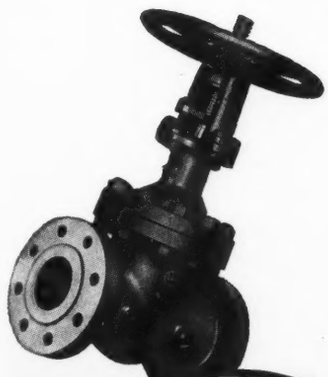
CONSISTING OF A HIGH-VOLTAGE, double-throw primary transfer switch, an air-cooled 3-phase transformer and network protector, distribution unit for secondary network systems transforms power from the primary voltage to secondary grid voltage. Primary air-break switch opens the exciting current of the associated transformer and will withstand a short-circuited current of 10,000 amp for two seconds without damage to or appreciable movement of its parts. Network protector is the 3-pole open type securely mounted on low-voltage end of the unit housing, and adequately spaced and barriered from all high-voltage cir-

No Shortage in *Widgets!*

● You may call them test bars. Our manufacturing department calls them detectives. Samples of every heat for *every* Darling Valve is subjected to the most severe pressure and abuse that modern test machines can develop.

Only when every test has been passed with a margin of safety enough for a bridge—can that metal be used for Darling Valves. Darling has the story of every Darling Valve ever made.

Metal that doesn't pass does not go into cheaper lines—there aren't any—it goes *out.* Nothing that bears our name will ever contain any but the finest metals our proud craftsmen know how to make. That, and their improved design, explain why thousands of users find Darling Valves last longer, cost less, help maintain maximum production.



Darling offers you a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

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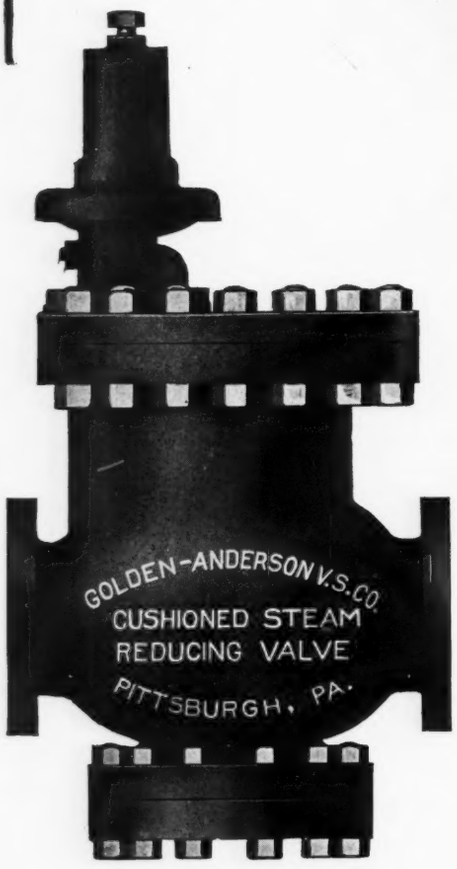
WILLIAMSPORT, PA.

Golden Anderson SPECIALTY VALVES



STEAM PRESSURE REDUCING

To insure a uniform terminal pressure on varying capacities, employ this superior G-A Steam Pressure Reducing Valve. It is particularly adaptable for intermittent or dead end service. Furnished in sizes ranging from 2½" to 12", it is of Double Extra Heavy cast iron, with a semi-steel, or cast steel body and bonnet. Trim consists of either bronze, monel metal or stainless steel. Efficiently handles 125 lbs. to 400 lbs. of saturated or superheated steam. Pilot control may be located remotely from the main valve. For a free copy of the latest G-A catalog . . . write today . . . it contains detailed construction and application data on the complete line of Golden-Anderson Specialty Valves.

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Altitude Control . . . Throttle and Emergency Stop . . . Check . . . and other types of valves.

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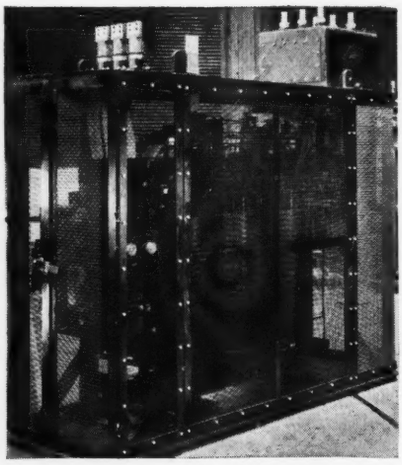


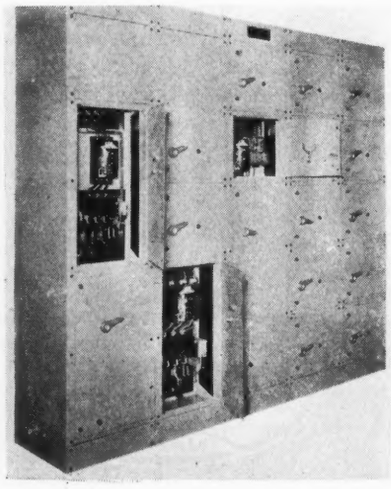
cuits of the unit to permit inspection, test and maintenance without danger of contacting high-voltage portions. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Welding Alloy

CASTOLIN EUTECTIC WELDING ALLOYS flow and bind at unusually low temperatures below the critical transformation point of metals and before the formation of critical stresses. Besides the low-temperature feature, the new alloy rods are further closely adapted to the metal to be welded. Alloys are used with a specially adapted Autochemic flux. The alloys are mostly applied in connection with the acetylene welding torch, but they may be used as well with the arc, carbon, natural gas, and furnace brazing. *Eutectic Welding Alloys, Inc, 40 Worth St, New York, N. Y.*

Motor Control Center

UNIT IS FOR GROUP CONTROL of ac motors up to 100 hp. For operation on 3-phase, 220-, 440- and 550-volt circuits, the motor-starter unit consists of a full-voltage magnetic starter providing ex-



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★ Years of Specialized Experience

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PREFABRICATION & INSTALLATION

FOR POWER AND INDUSTRIAL PLANTS

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. . . THIS MEMORANDUM TO YOUR ENGINEER IN CHARGE OF BOILER OPERATION

Please give me the facts about "BAERITE"

SIMPLIFIED WATER TREATMENT FOR BOILERS AND CONDENSERS

QUESTIONS

TO DISCUSS ABOUT YOUR POWER COSTS

- Is your present water treatment doing the complete job "Baerite" will do?
- Can you safely operate 300 days between boiler inspections—and have no delays or complaints?
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FACTUAL DATA

We will gladly send to you or your engineer in charge of boiler operation, complete factual data on "Baerite" Water Treatment for boiler feed waters or condensers. "Baerite" may still be new to you, but it is time-tested and proved. Just drop a line today. There is no obligation.

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ternal manual reset, thermal overload, and low-voltage protection. The entire control center is finished and assembled ready to receive line, motor and control circuit connections. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Air Raid Siren

AIR RAID SIREN IS AUDIBLE for miles, according to manufacturer, and has a rising sound pitch that reaches its maximum tone in from three to five seconds.

Has a sharp sound cutoff, making it useful for signaling. The unit operates on steam or air at 50 to 250 lb, 425 F temperature. The unit is constructed of all bronze or steel and bronze. *Foster Engineering Co, 109 Monroe St, Newark, N. J.*

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TEMPILSTICKS ARE USED for signaling desired preheating temperatures in the welding of steel, cast iron and nonferrous metals, for local heating, heat treatment and metal fabrication generally. Tempilsticks have sharp, rapid melting action at stated temperatures. A 300-Tempilstick drawn across the heated surface leaves a chalk-like mark at surfaces below 300 F, which will melt into a liquid streak when the surface temperature reaches 300 F. Tempilsticks are safe, do not corrode metal, pit or leave objectionable stains that

"WE SELECTED HAYS CONTROL BECAUSE IT IS EASIER FOR OUR OPERATORS TO UNDERSTAND"

...*So said* THE CHIEF ENGINEER of the above boiler room located in a mid-west municipal light plant. He went on to explain to two engineers* who were investigating several combustion control systems—

"Our men lived with Hays Automatic Combustion Control in our old plant for several years and they liked its simplicity, and its positive operation. Because it was easier to understand than the other systems on the market they took a keener interest in it and produced better results."

"Before selecting boiler control for our new high pressure plant I made trips to several near by cities inspecting the most recent installations of all types of control systems. These trips served to confirm my original opinion of Hays, so we selected Hays for our new plant also."

*The result of this interview was the sale of complete Hays Automatic Combustion Control for 7 boilers in a large automotive product plant.

HAYS *automatic* COMBUSTION CONTROL

is being preferred more and more over other control systems for very definite reasons. In the first place it is completely electric, which simplifies design, installation and operation.

It is the only system that has all instruments and controllers centralized on a single panel and not scattered all over the boiler room or hung on the side of the boiler. Adjustments are direct and not dependent on air pressures, oil pressures, and the complicated valve mechanisms made necessary by most other designs.

You will want to learn more about this thoroughly modern system that is maintaining boiler room efficiency and lowering operating costs in hundreds of plants. Send for 40-page catalog 41-304 today.

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. . . Welded Outlets for Piping . . .

For Making Better, Stronger Right-Angle Welded Branch Pipe Outlets

WeldOlet

ThredOlet

Socket-End WeldOlet

BECAUSE they make leakproof junctions of full pipe strength . . . . because they improve flow conditions, reducing turbulence and friction to a minimum . . . . Bonney WeldOlets, ThredOlets and Socket-End WeldOlets will make better, stronger right-angle branch pipe outlets than any other type of fitting.

No templets are needed. The fitting is used as a templet. The hole in the main pipe, in most cases, is cut after the fitting is installed. They eliminate all threading and fitting of the main line and simplify alignment of main and branch pipes.

Standard, stock fittings in size-to-size and reducing sizes are of drop forged steel. For special applications or where unusual conditions exist, they can also be supplied in Toncan Iron, wrought iron, brass, Monel, Everdur, etc. WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for every type of piping installation and for all commonly used pressures and temperatures.

Your local distributor will be glad to tell you the complete story about savings which can be effected, or write for Bulletin WT29—TODAY.

EASILY INSTALLED

Mark center lines and tack the fitting into place.

Then weld the fitting to the main pipe.

Remove the button, which will also permit inspection of inside of joint.

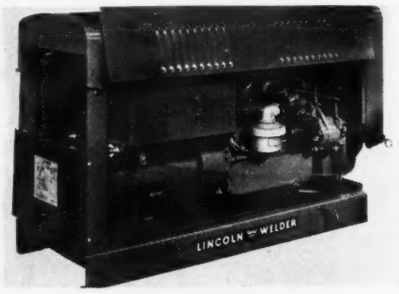
Then attach the branch pipe.

BONNEY FORGE & TOOL WORKS
Forged Fittings Division - Allentown, Pa.
Forged by the Makers of
The Finest that Money Can Buy
BONNEY TOOLS

cannot be later removed. The company also makes Tempil Pellets used for similar purposes. *The Tempil Corp, 132 West 22d St, New York, N. Y.*

Engine-Driven Arc Welder

ENGINE-DRIVEN UNIT is for job welding and embodies a new system of engine-speed control for maximum fuel economy and minimum engine wear. Of 200-amp size (see illustration) this new unit is engineered with a current range of 40 to 250 amps, and can be used for welding light-gage metal, repairing cast iron parts such as engine blocks, fabricating machine parts and structures, and for hardfacing worn parts. It can weld practically all metals and alloys with bare or shielded-arc electrodes, or with the carbon arc where desirable. The welder is powered by a Hercules industrial engine equipped with centrifugal governor, high-tension magneto with impulse starter coupling, and oil bath air cleaner. *Lincoln Electric Co, 12818 Coit Road, Cleveland, Ohio.*



Blackout Paint

VITA-VAR BLACKOUT PAINT forms a tough elastic film that will not wash off in rain. It is a permanent coating and does not have to be renewed—although it can easily be removed by a razor-blade scraper or paint and varnish remover. The paint not only prevents the transmission of light, but also prevents the reflection or glare from exterior sources. It is said not to be affected by atmospheric conditions or by moisture and temperature conditions inside the plant, as it is formulated with a special vehicle that resists such conditions. *Vita-Var Corp, Newark, N. J.*

Fluorescent Unit

MITCHELL FLUORESCENT UNIT COMES in two models—Model No. 2034, using two 40-watt fluorescent bulbs, and Model No. 2035, using three 40-watt bulbs. Both are high-tensity, high-efficiency units with a 13½-deg cutoff which eliminates glare from all normal

DISSTON meets tough feedwater problem with COCHRANE Deaerating Softener

New boiler house of Henry Disston & Sons, Inc., H. M. Wilson Co., Engineers & Constructors, Philadelphia.

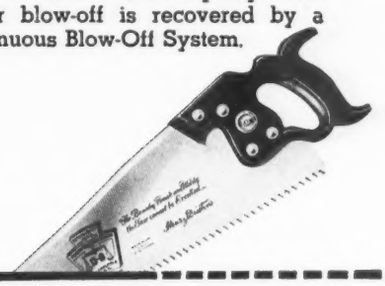
View showing, above, the oil removal filter and two Cochrane-treated Water Filters and Sedimentation Tank of Cochrane Deaerating Hot Process Softener. Laboratory table in foreground.

AT the plant of Henry Disston & Sons, Inc., in Philadelphia, the normal power needs of this century-old manufacturer of saws, tools, files, knives and steel, plus the enormous defense load it has recently taken on, are amply provided for in the new high-pressure boiler plant just completed, in which a Cochrane Deaerating Softener and a Cochrane Continuous Blow-Off System are a part of the ultra-modern equipment.

The raw boiler water is river water with a hardness of 40 to 50 parts per million. It enters the softener at 60°F. from the heat exchanger of the Cochrane Continuous Blow-Off System and is treated with phosphate, the feeding of which is automatically controlled by a Cochrane Flow Meter. The treated make-up is deaerated by atomization in the softener. Condensate, after passing through a Cochrane Oil Removal Filter, is deaerated separately in the softener and joins the treated raw water at the feed pump. Heat from the boiler blow-off is recovered by a Cochrane Continuous Blow-Off System.

★ Many unique applications of feedwater treatment together with a discussion of Boiler Feedwater Analyses and Their Interpretation are included in Cochrane's handbook on Hot Process Softening, a copy of which will be mailed on receipt of coupon below.

COCHRANE CORPORATION • 3106 N. 17th ST., PHILADELPHIA, PA.



Cochrane

SOFTENERS • DEAERATORS • FLOW METERS • STEAM SPECIALTIES

Cochrane Corporation
3106 N. 17th St., Philadelphia, Pa.

Please send me a copy of Cochrane Publication 3106 (Hot Process Softening).

Name _____

Firm _____

Address _____

City _____ State _____

PRODUCE MORE FOR VICTORY— KEEP BOILER TUBES CLEAN— USE WILSON TUBE CLEANERS

To win this war quickly and decisively, we must produce *more* than ever before. Every extra pound of steam a boiler produces—every extra hour that it remains in operation—makes our ultimate victory surer and brings it nearer.

Wilson Tube Cleaners play a vitally important part in the nation's war effort by cleaning boiler tubes *faster, better, more economically* and thus *increasing* boiler efficiency and plant production.

There is a Wilson Tube Cleaner, cutter head, brush or other accessory for *quickly, thoroughly* and *economically* cleaning *any* straight or curved ferrous or non-ferrous metal tube—of large or small diameter.

Write for the name of our representative nearest to you or for a copy of our thirty-six page catalog fully describing and illustrating the complete line of Wilson tube cleaning equipment.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

MAINTAIN VITAL PRODUCTION FLOW . . .
by lessening shut-downs due to furnace relinings. The exceptionally high bonding strength of

ADAMANT
FIRE BRICK CEMENT

Makes the joints as strong as the bricks they bond.

WRITE for details of impartial laboratory tests proving Adamant's exceptional bonding strength.

BOTFIELD
REFRACTORIES COMPANY
784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co. Ltd. 171 Eastern Avenue, Toronto

viewing angles. Units are power-factor corrected and have latest approved ballasts and starters. *Mitchell Mfg Co. 2525 Clybourn Ave, Chicago, Ill.*

Blackout Bulb

BULB IS LINED INSIDE with a pure silver reflector lining that hides all filament glare and projects the light downward. Light leaks are prevented by a black

silicate coating that covers the bulb up to the extreme lighting end, which is a deep blue. Bulb consumes 25 watts. *Wabash Appliance Corp, 335 Carroll St, Brooklyn, N. Y.*

Water Treatment

TANALGINATE IS THE RESULT of combining both protective and reactive colloidal materials, having as its base both tannin and alginate. Tanalginate is used in conjunction with inorganic chemicals such as phosphates or alkalies. It is not in itself a complete treatment for conditioning water. When used under competent supervision and control, the results obtained by such dual treatment are claimed to be far beyond the limitations of inorganic chemicals alone. The characteristic of the sludge is said to be vastly changed and becomes highly liquid and not subject to dehydration under the intense temperatures

5 YEARS OLD... BUT THE OIL IS STILL

LIKE NEW

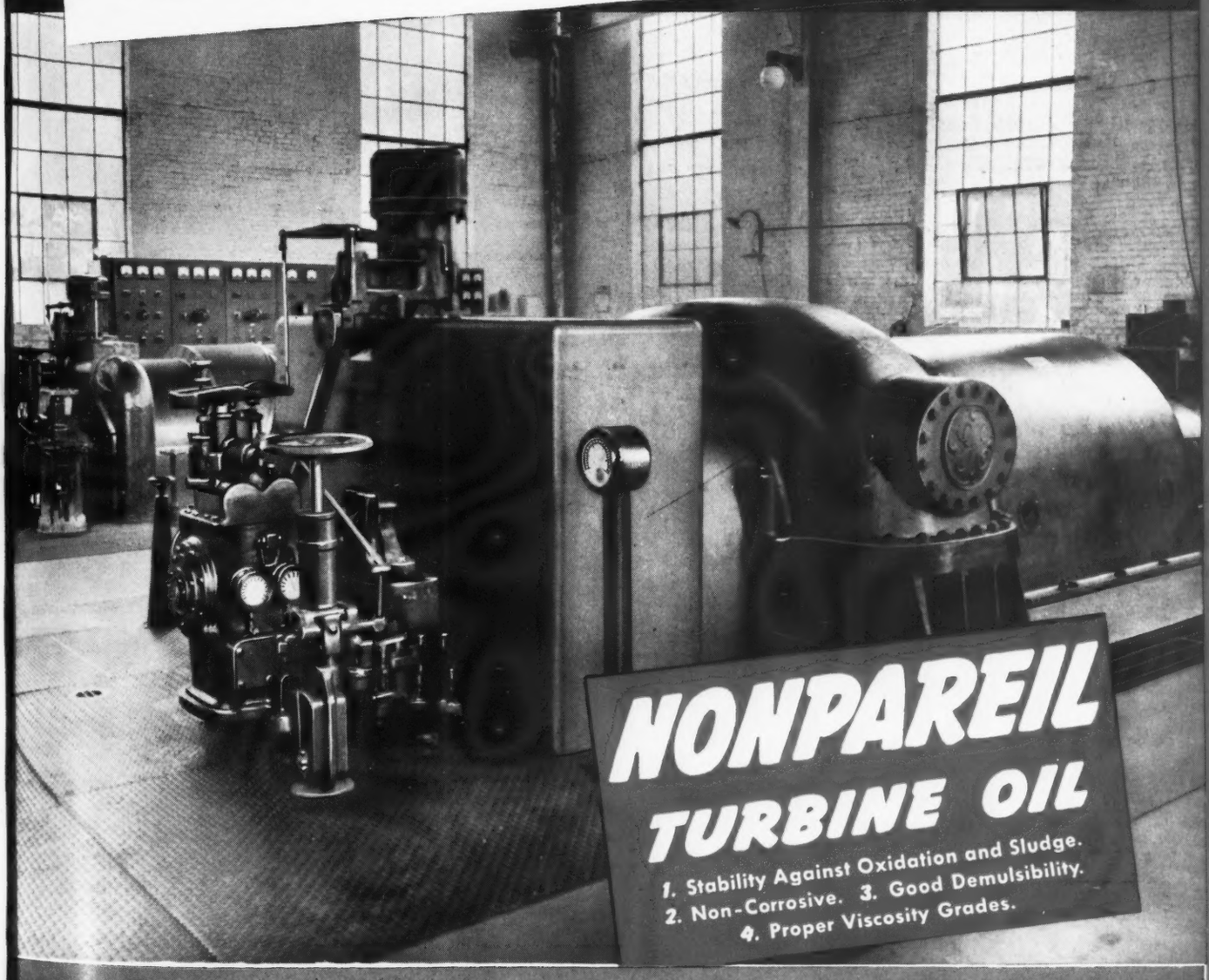
• PERHAPS you have a turbine oil that's five to ten years old. But how much has it cost in treating and sweetening to keep acidity low? How much of the original oil has been lost through sludge removal? How much time have your operators spent cleaning the turbine oil system, settling tanks, and other equipment you need to get a few years' extra life from the oil?

Add these costs together and you have part of the saving you make when you install Nonpareil Turbine Oil, because it never needs sweetening or treating, and stays in the turbine year after year without becoming more acidic or forming sludge.

A 2,000 KW turbine in the Michigan municipal plant (pictured here) has operated on Nonpareil 5 years. A recent inspection shows the oil to have the extremely low neutralization number of 0.05 mgKOH/gm. This oil is *guaranteed* to last as long as the turbine.

Have a Standard Oil Engineer explain fully what this *guarantee* means to you. Write the Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

Copr. 1942, Standard Oil Company (Indiana)



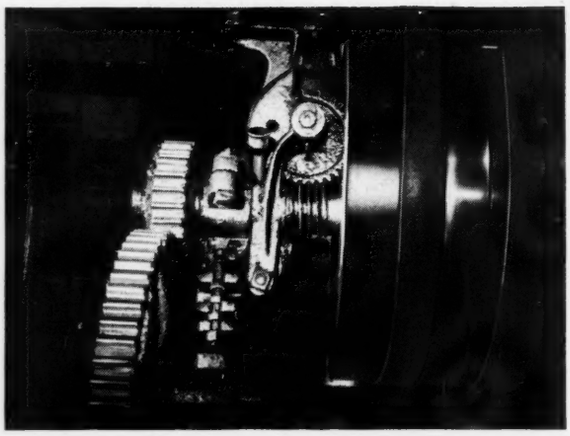
NONPAREIL TURBINE OIL

1. Stability Against Oxidation and Sludge.
2. Non-Corrosive. 3. Good Demulsibility.
4. Proper Viscosity Grades.

STANDARD OIL COMPANY (INDIANA)

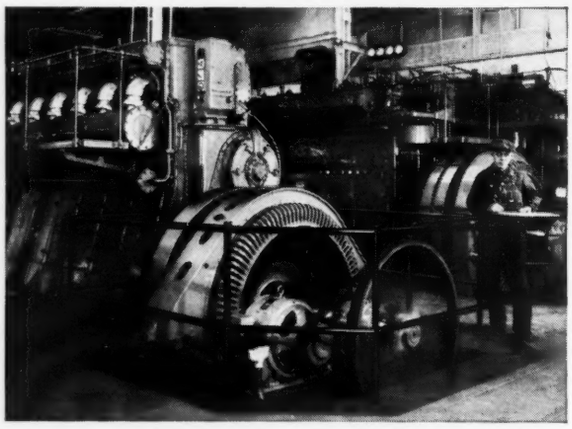
LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION E

LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION



NO TIME TO REPLACE DRIPPING BEARINGS? TRY— STANODRIP

Have you been putting up with dripping line shaft and equipment bearings because there isn't time to replace them and because they are hard to get? You can still get rid of the oil-soaked floors under these bearings and save the time and lubricant they waste. Do as one Michigan laundry superintendent did when he found that he had to lubricate machine bearings often and mop oily floors—and, worst of all, that oil was thrown on the clean laundry from time to time. He took a Standard Lubrication Engineer's advice and tested Stanodrip. A three-month trial showed consumption was reduced 75%—Stanodrip stayed *in* the bearings, *off* the floor and laundry.



"THE ONLY OIL CONSIDERED" AFTER 10-YEAR RECORD WAS NONPAREIL DIESEL OIL

It was time to choose the lubricating oil for the new Diesel shown in the foreground of the above picture. The second engine had operated 10 years on Nonpareil Diesel Oil. Operator Oliver Lindahl at this Missouri municipal plant looked at its record. No stuck rings in 10 years. No sludge or excessive carbon. Low maintenance and oil consumption. No engine could have given less trouble. And, with that evidence, no other oil was considered. Nonpareil got the job. Ask a Standard Oil Engineer to recommend the grade you need and test it. Let your records show how economical Diesel operation can be.

SUPERLA GREASE APPROVED FOR MILL BEARING LUBRICATION

Alvin Enerson, pictured above, is giving you the benefit of a lot of experience, when he says, "Your Superla Grease has been in use in our pellet mill for several months. It has given the results we have been looking for. Not a single bearing failure has occurred in this period."

He had tried many greases on this mill in the plant of the Stockdale Fertilizer Co., Morrison, Illinois. But none of them would stand up. Leakage, high grease consumption, and bearing trouble persisted.

When a Standard Lubrication Engineer first suggested testing Superla, it was just another faint hope of help that prompted Mr. Enerson to try it. But there is no doubt in his mind now. Superla not only ended bearing trouble, but it cut consumption 40%, and saved hours of machine productive time.

LUBRICATION ENGINEERING WILL HELP YOU SAVE TIME AND MAINTENANCE

Right now, when your time is at a premium, you should meet the Standard Lubrication Engineer in your locality. His suggestions may save a lot of your time experimenting with lubricants. The sooner your lubricating problems are solved, the more you save in maintenance expense and lost machine time. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

Multiply by 127,272

To make the eleven army cots you see here requires 128 feet of steel tubing, 195 feet of angle steel, 1073 feet of spring wire and 1933 feet of galvanized wire - not to mention rivets and other small pieces of steel.

Multiply these figures for 11 men by 127,272 and you have the amount of steel fabricated into beds for our new army of 1,400,000 men - a total of 451 million feet of material - 33,367 tons of steel.

Such an essential item as beds for soldiers is just one of the many defense uses for which much of the regular production of Youngstown mills is going now. This, of course, is in addition to the ever-increasing tonnage of special steels produced for armament.

Day and night, our plants are working to deliver every ton of steel possible.

25-27D

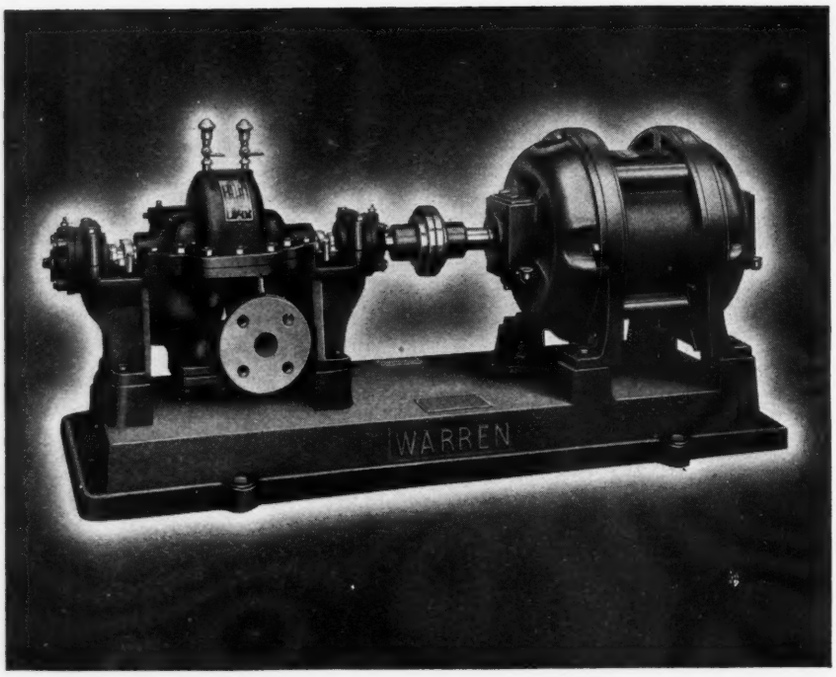
QUALITY TRADE MARK YOUNGSTOWN SERVICE

Youngstown products include Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steels

General Offices - YOUNGSTOWN, OHIO



WARREN PUMPS

Have Liberal Clearances

Close clearances between impeller and case rings in a centrifugal pump often make possible high shop test efficiency. But careful pump buyers know that excessive wear will quickly destroy that efficiency and result in increased power consumption, with possible overloaded driver.

In Warren Pumps, the guaranteed efficiencies are based on liberal clearances to make certain that they will be maintained for long periods.

Oversize bearings, extra-heavy shafts, large case rings and correctly designed impellers, are some of the many other reasons why Warren Pumps deliver the lowest pumping costs per year . . . year after year.

For further details ask for Bulletins 228 and 229

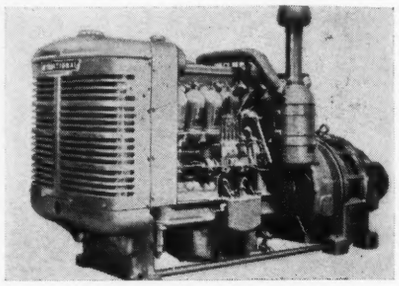
WARREN PUMPS

Warren Steam Pump Company, Inc., Warren, Massachusetts

encountered in high-pressure boiler operation. Tanalginate can be safely fed through feed lines as it exhibits a positive inhibiting action upon feed line deposits. It is supplied in several different formulations and pH values, depending entirely upon the nature of the water to be treated. *The Bird-Archer Co, 400 Madison Ave, New York, N. Y.*

Diesel Electric Power Plant

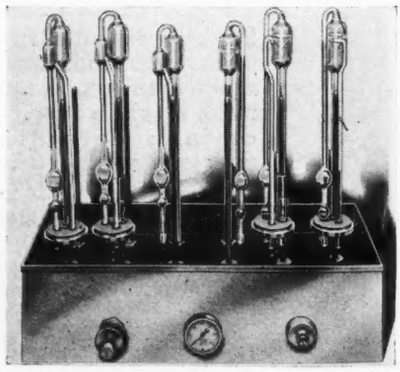
READY-POWER DIESEL-ELECTRIC plants are powered by International Harvester diesel engines. They are made for both ac and dc, and are designed around



four different sizes of engines operating at speeds of either 900 or 1200 rpm. Eight plant models are available which cover the range between 12½ and 50 kw. Company generators are capable of producing all the electrical power that the engine can develop. *The Ready-Power Co, Detroit, Mich.*

Viscosimeter Cleaning Apparatus

CLEANING AND DRYING APPARATUS primarily was designed for glass viscosimeters for determining kinematic viscosity. However, this equipment is also adaptable for use in connection with the cleaning of other types of glassware, such as test tubes, pipettes, etc. The tubes are placed over and supported by vertically extended metal capillary tubes through which the cleaning fluid is sprayed. Drying is accomplished by passing air under pressure through the



50,000 LBS. CONTINUOUS GUARANTEED
70,000 LBS. CONTINUOUS DELIVERED

Here's help in getting more out of your boilers burning natural gas.

Coppus-Dennis Fanmix Gas Burners helped a recent boiler installation exceed its guarantees by a very welcome margin. The maximum guaranteed capacity of the boiler was 50,000 pounds continuous and 60,000-pound 15-minute peaks. Actual average hourly load was 70,000 pounds with peaks of several hours' duration of 75,000 pounds. Air heater exit gas temperature was much lower than guarantee figure, showing complete combustion in the furnace. That is performance that means a lot in times like the present.

Bulletin 410-3 describes perfect gas-air ratio . . . instantaneous combustion . . . small combustion space . . . absence of "hot spots" . . . and dozens of other features. It's a Coppus "Blue Ribbon" Product. Check the coupon.

COPPUS

$$$
. . . OR IS IT A JOB FOR A HORSE?
On small jobs, save the money you'd have to invest in an ordinary large-sized steam turbine. Coppus "Blue Ribbon" Steam Turbines include six frame sizes from 150 HP down. Remember Coppus when you need horse power, not elephant power. Bulletin 135-9.
COPPUS

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY . . . ENGINEERED FOR YOU

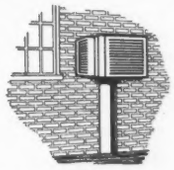
COPPUS ENGINEERING CORPORATION

323 Park Avenue, Worcester, Mass.

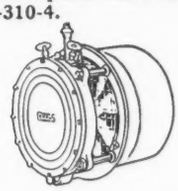
Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in Sweet's Product Reference.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(Check the ones you want)



☐ Coppus Air Filters. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.



☐ Coppus Type C Turbo Blower. For undergrate draft. Bulletin 145-6.

☐ Coppus Heat Killers. High speed blasts for cooling and drying furnaces, motors, generators, products, etc. Bulletin 160-5.

☐ Coppus Welding Exhauster. For exhausting welding fumes and other injurious gases from confined working spaces. Bulletin 168-1.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

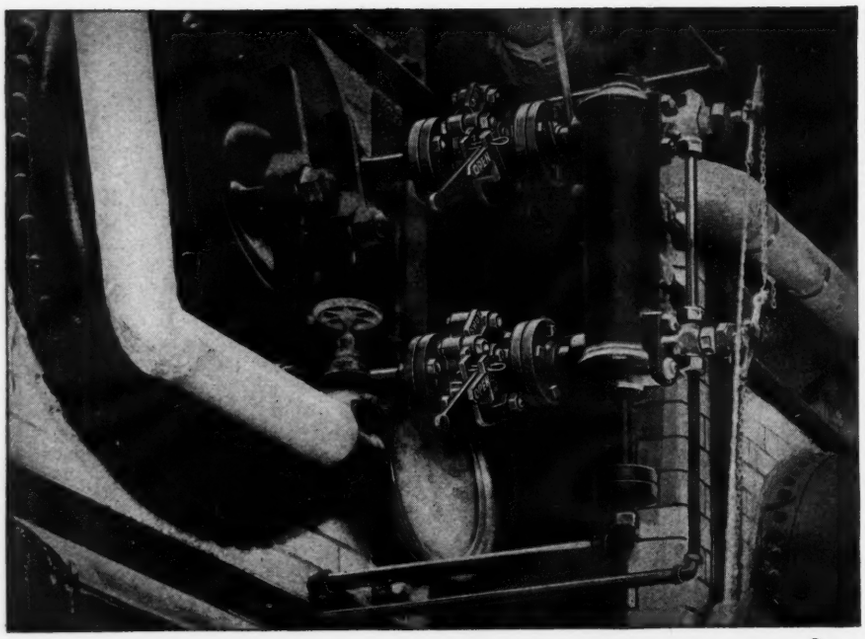
☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

☐ Coppus Steam Turbine (described in this ad).

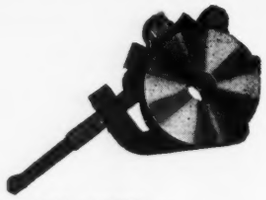
NAME .....

COMPANY .....

ADDRESS .....

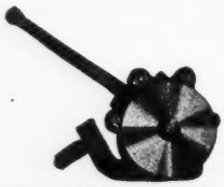


EVERLASTING
WATER COLUMN VALVES



for dependability and Safety

WHEN OPEN . . .
the Everlasting Water Column Valve provides a straight through unimpeded passageway. The fact that the valve is open is visible at a glance and, a lock on the open indicator prevents accidental closing.



WHEN SHUT . . .
the record of the Everlasting Valve assures the operator of a leak-tight closure so that a new gauge glass can be installed without the necessity for protection of the operator's face and hands from escaping steam or water.

Meeting every provision of the A. S. M. E. Boiler Construction Code, and widely preferred by experienced engineers, the Everlasting Water Column Valve perfectly fills the requirements of this service.

These leak-proof valves permit the replacement of gauge glasses and trycocks in complete safety, without danger of the operator being scalded and without shutting down the boiler. In addition to the important features mentioned at the left, the arrangement of the valve is such that the weight of the operating parts tends to keep the valve in an open position.

Full particulars will be sent on request.

EVERLASTING VALVE COMPANY
Jersey City . . . . . New Jersey

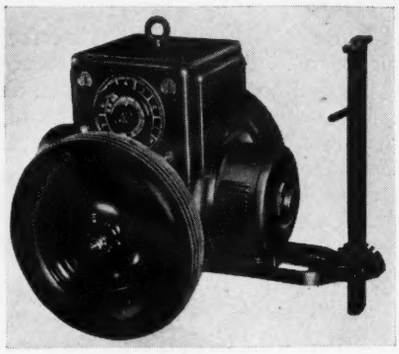
Everlasting Valves

for everlasting protection

tubes. Pressure is regulated by means of special valves, and the amount of pressure may be closely controlled and observed. To prevent excessive use of solvent or cleaning fluid, a spring valve is used which closes when the valve handle is released. *C J Tagliabue Mfg Co, Brooklyn, N. Y.*

Welding Trailer

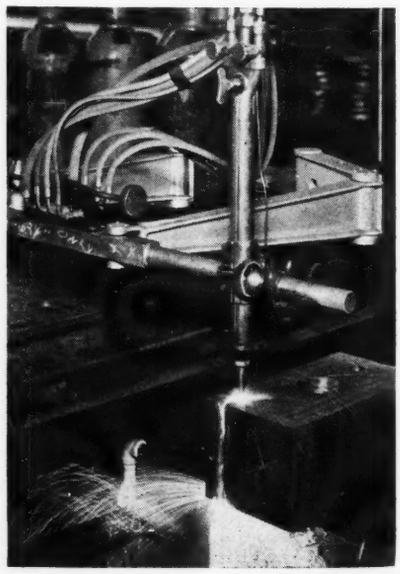
TWO-WHEELED, LIGHTWEIGHT, pneumatic-tired trailer for mounting 200, 300, and 400-amp Hobart electric drive welders. Trailer is so designed that mounting the welder is accomplished easily by means of three bolts in trailer frame which register with three holes in



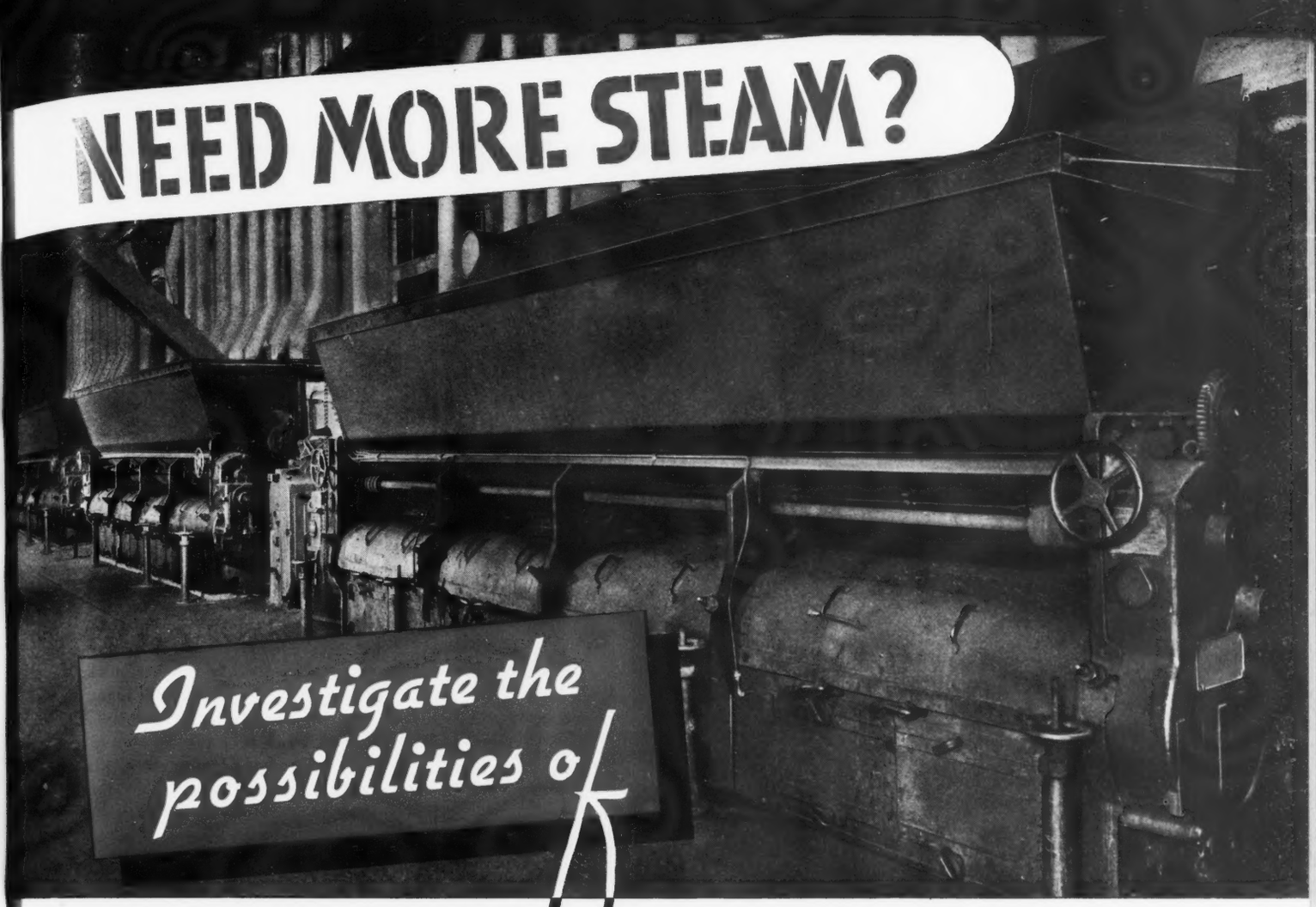
legs of welding machine. Combination tow bar and standing support has a hand-operated ratchet for locking support arm in position. Unit is easily moved by hand by virtue of its low, underslung construction, narrow tread, and precision method of balancing. *Hobart Bros Co, Troy, Ohio.*

Cutting Tips

AIRCO "45" HIGH-SPEED MACHINE cutting tip has a nozzle with a divergent exit portion, making it possible to eject



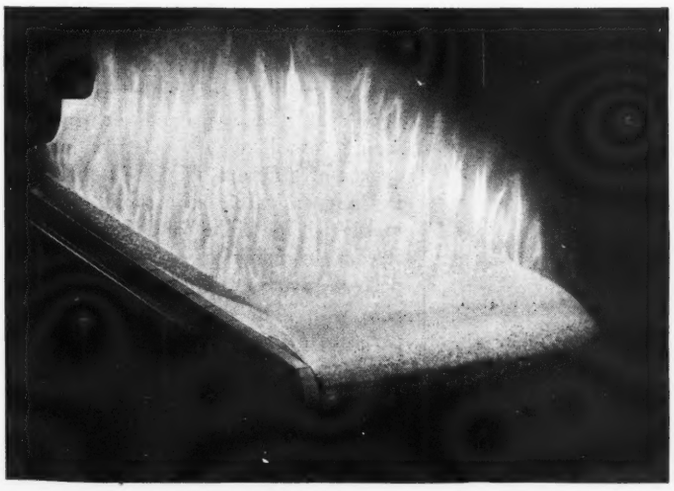
NEED MORE STEAM?



RESTOKERING YOUR PRESENT BOILERS

• By increasing the output of your present boilers, Stowe Stokers will give you more steam—not next year—but within the next few weeks, just as they have greatly increased the steam outputs of other plants.

A large automobile manufacturer, for instance, jumped his boiler output from 200% to 400% of rating when he put in a Stowe Stoker and has bought seven more since. A large utility jumped the capacity of a unit from 75,000 lbs. to 135,000 lbs. with a Stowe Stoker and has bought two more since. Other installations in the rubber, leather, textile, tobacco and salt industries—to name only a few—are producing surprising results.



Currently we are in a position to make from 50 to 70 day delivery—And remember, restokering involves a minimum of new capital investment and a minimum "loss-of-use" for change over.

Send for a descriptive catalog or a Stowe Stoker engineer to study your situation and make a complete, honest, impartial report of what we can do for you. There is no obligation either way. Write, telephone, or use the coupon today.

THE JOHNSTON & JENNINGS CO.

878 Addison Road
DETROIT CLEVELAND, OHIO CHICAGO

Engineering and Sales Representatives in
New York • Pittsburgh • Kansas City • St. Louis

STOWE STOKERS

GIVE YOU MORE STEAM FROM LESS COAL

THE JOHNSTON & JENNINGS COMPANY
878 Addison Road, Cleveland, Ohio

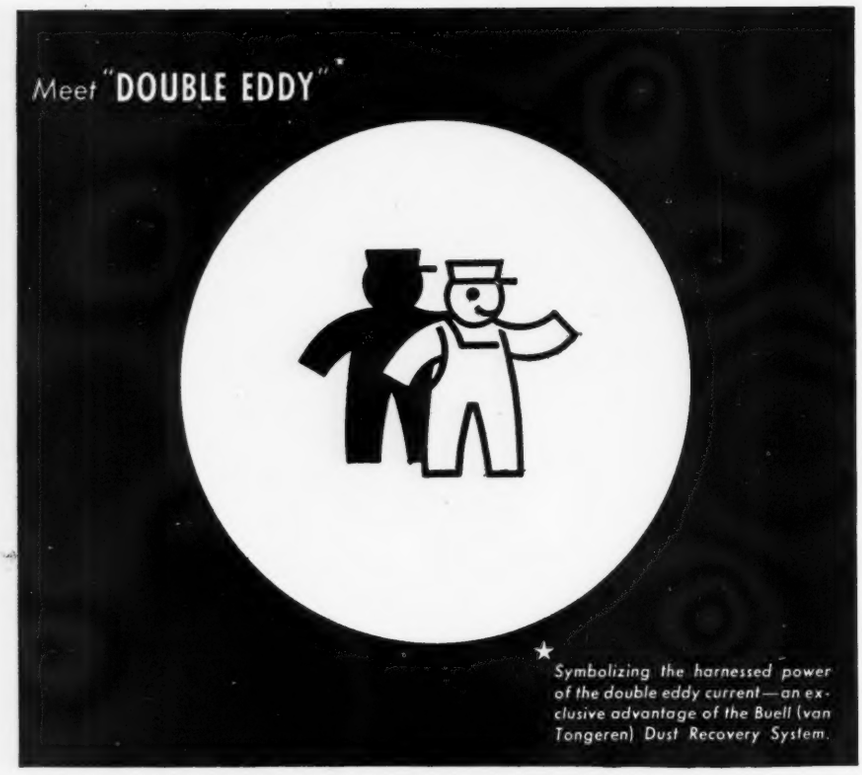
Gentlemen: Please send

☐ A copy of your new Stowe Stoker Catalog
☐ An engineer to study and report on what you can do to increase the output of our present boilers

Name _____

Company _____

City and State _____


Meet "DOUBLE EDDY"*
*Symbolizing the harnessed power of the double eddy current—an exclusive advantage of the Buell (van Tongeren) Dust Recovery System.

MISCHIEF-MAKER FOR EVERYONE BUT BUELL

"Double Eddy" is the little-man-who-saves-you-money on dust recovery. He works exclusively for Buell—and, on Buell equipment, has proved his ability as a dust recovery man all over the world, in every industry where dust is a problem.

The double eddy (an air current phenomenon present in all cyclone-type dust collectors) is a mischief-maker for everyone but Buell—causing trouble, cutting down efficiency. The reason? *No one but Buell can use the van Tongeren Cyclone!* This patented system embodies the only known method of harnessing the energy of the double eddy current to increase collection efficiency *on all dust sizes.*

For the complete story of "Double Eddy", send for our 24-page "Bulletin P-3, Dust in Industry".

BUELL'S 6 PLUSES

These are the *plus* advantages that give Buell (van Tongeren) Dust Recovery Systems outstanding superiority...

- *High Recovery Efficiency*
- *Low First Cost*
- *Low Maintenance*
- *Long Life*
- *Unlimited Capacity*
- *Fractional Efficiency Performance Guarantees*

BUELL ENGINEERING CO., Inc.
10 Cedar St., New York

Nation-wide service through offices of either Buell Engineering Co. or B. F. Sturtevant Co.

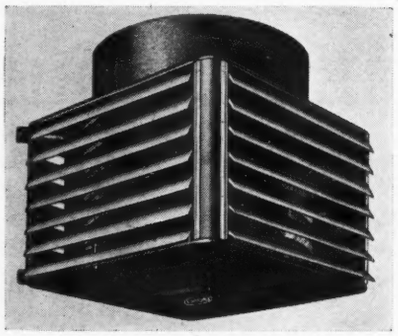
CONSULT BUELL *First* IN DUST RECOVERY
for Chemical • Rock Product • Metallic • Food • Flue or any other dusts

buell DUST RECOVERY SYSTEMS

a narrow, high velocity stream of oxygen practically free of exit turbulence that burns a narrower path to the metal than the conventional cutting tip. As a result of burning away less width of metal in a cut, the unit cuts with no increase in oxygen consumption. As the oxygen stream penetrates steel, its velocity is constantly dissipated. The divergent tip principle increases the velocity of the oxygen stream and provides a higher oxygen concentration at greater depths, thereby increasing the oxidation rate of the metal being cut. The tip fits standard machine cutting torches. *Air Reduction, 60 East 42d St, New York, N. Y.*

Unit Heaters

CARRIER TYPE 46S FIVE-WAY UNIT heaters are vertical, suspended, propeller-type heaters designed to provide quick, thorough heating in industrial, manufacturing and many types of commercial buildings. They supply a maximum air quantity at low final temperature, giving the greatest economy of heating with even temperature in the occupied zones. Discharge air louvers permit control of the angle of air discharge



and the velocity of air discharge, allowing the use of one large unit in place of several smaller ones, while maintaining comfortable heating conditions by providing excellent air distribution in spaces of different shapes. Each louver is independently adjustable, thereby making it possible to deflect the air stream in many directions to obtain perfect coverage. The units are available with both standard and low-temperature coils suitable for steam pressures up to 100 lb, and for hot water. *The Carrier Corp, Syracuse, N. Y.*

Fluorescent Lamp Lock

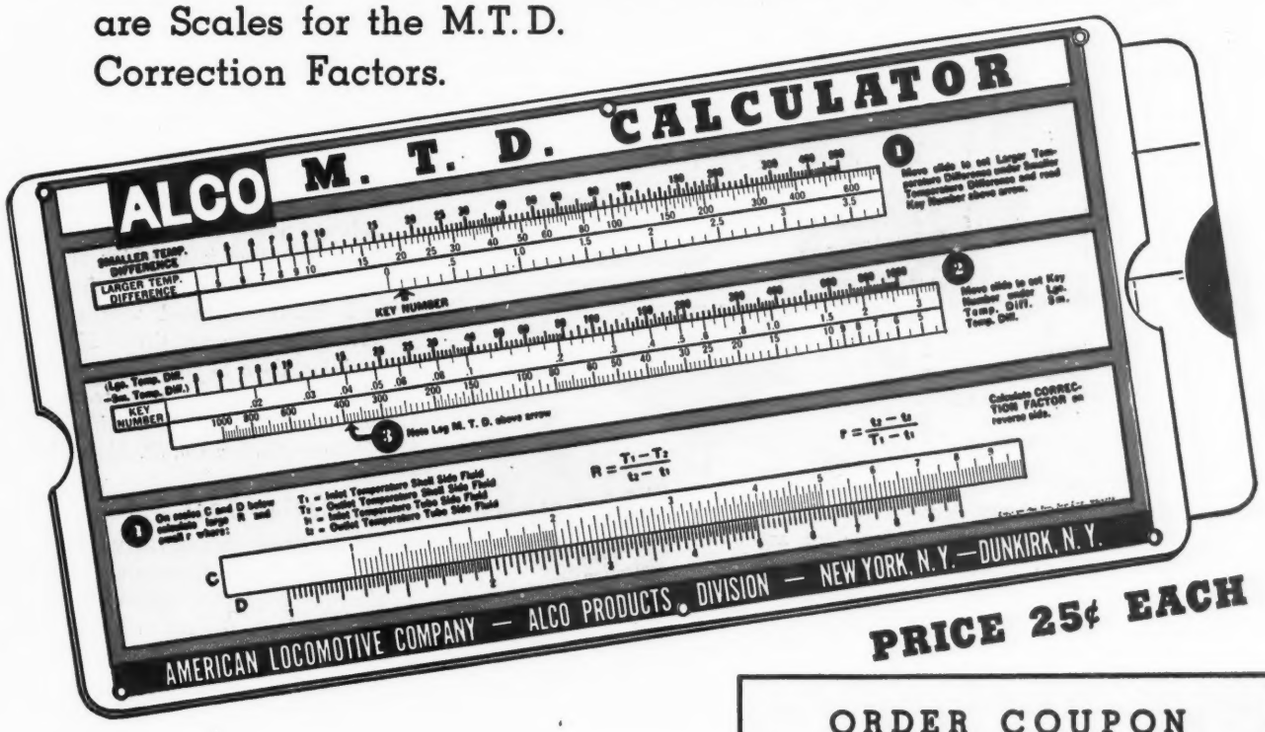
FLUR-O-LOCK IS A DEVICE for locking fluorescent lamps against vibration to prevent premature lamp failure, loosened lamps, guard against accident hazard, and eliminate costly lamp replacements. To install, place one lock on the contact prongs at each end of

ALCO

M. T. D. CALCULATOR

SOMETHING NEW FOR ENGINEERS – AN AID IN THE ESTIMATING OF HEAT EXCHANGER SURFACE

On the Front Side of the Calculator are Scales for the Calculation of the Logarithmic M.T.D. As well as C-D Scales for Multiplication and Division. On the Reverse Side are Scales for the M.T.D. Correction Factors.


ALCO M. T. D. CALCULATOR
SMALLER TEMP. DIFFERENCE
LARGER TEMP. DIFFERENCE
KEY NUMBER
AMERICAN LOCOMOTIVE COMPANY — ALCO PRODUCTS DIVISION — NEW YORK, N. Y. — DUNKIRK, N. Y.

PRICE 25¢ EACH

Steam Generators
Heat Exchangers
Feed Water Heaters
Diesel Oil & Water Coolers
Condensers

Alco • Fin Heat Exchangers
Pre-Fabricated Piping
Electric Welded Steel Pipe
Pressure Vessels
Kiln Shells

For Complete List Write for Bulletin 1030

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ALCO PRODUCTS DIVISION
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The WRIGHT Line FOR HIGH SPEED PRODUCTION

There is a *Wright* hoist for every job —the **WRIGHT SPEEDWAY ELECTRIC HOIST,** the **WRIGHT IMPROVED HIGH SPEED HAND-OPERATED HOIST,** the **WRIGHT TRAVELING CRANE, JIB CRANE, MONORAIL TROLLEY.** They handle anything from ¼ to 50 tons—*fast,* safely, economically.

But you get more than the hoist fitted exactly to your needs. *First*—you get the Wright engineering experience which assures you the most economical solution of your problem with the **WRIGHT HOIST.** *Second*—you get inbuilt safety in every part. The load chain, for instance, has a safety factor of 7 to 1. The bottom hook slowly opens to indicate overload.

This drop forged, special steel hook, possesses such an unusual degree of ductility it will straighten out before any part of the hoist is damaged. *Third*—assured operating efficiency is a characteristic of every **WRIGHT HOIST.** Their action is smooth, positive, fast. Finally—Wright gives you year-in-and-year-out dependability and the very minimum of maintenance cost.

Let Wright engineer your hoisting and crane problems. Work through the Wright distributor in your city. You'll find him listed in the classified telephone book.

WRIGHT MANUFACTURING DIVISION
YORK, PENNSYLVANIA
In Business for Your Safety

ACCO

AMERICAN CHAIN & CABLE COMPANY, INC.
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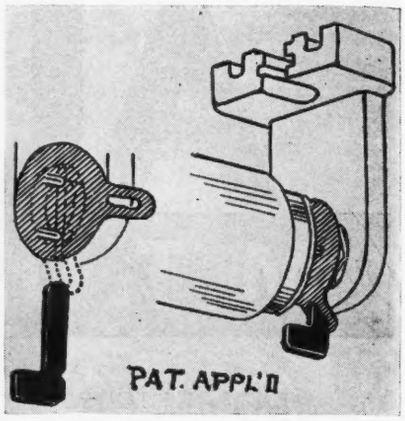


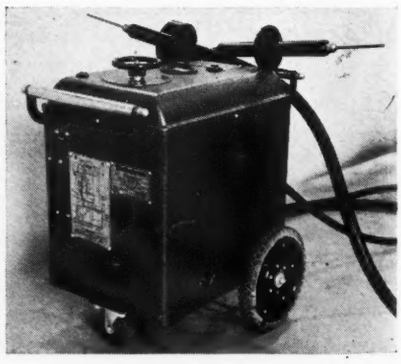
lamp. Set lamp in socket. Insert keys in socket slot, and see that notch in key is engaged in hole in cam of block. This holds lamp in locked position (see illustration). To remove lamp release tab from key. Remove key from lock at each end of lamp before turning lamp. *Laduby Co, New Haven, Conn.*

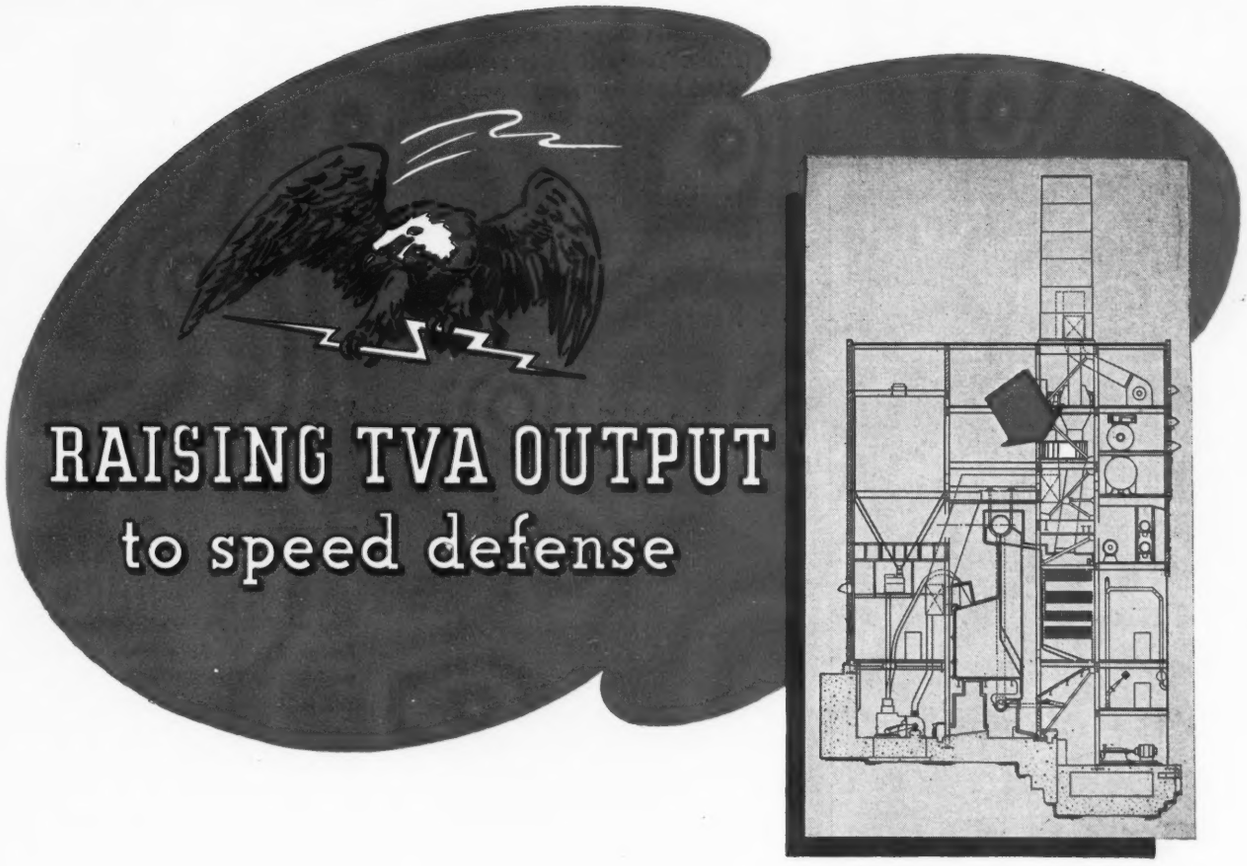
Iron Bearing

COMPANY ANNOUNCES SELFLUBE porous iron bearings in addition to line of self-lubricating bronze bearings. The new porous iron bearings are stronger than the bronze units and are interchangeable with them in most applications. Selflube porous iron bearings are made from powdered iron, which is molded to size in the shape desired, then baked, and finally saturated with oil. They have an average porosity of 25 to 35%, enabling them to store a large amount of oil which forms a protective, continuous oil film on the bearing surface. *Keystone Carbon Co, St. Marys, Pa.*

Insulation Test Set

UNIT IS DESIGNED FOR TESTING insulation of diesel-electric locomotives and other electric equipment. Available in ½- and 2-kva ratings, the set includes a high-voltage transformer, a means of regulating the test voltage and the necessary overload and undercurrent devices for protection. Voltage supply is received at the set through a breaker with thermal elements for protecting it from excessive overload. An instantaneous





High-efficiency steam generating units of the new Watts Bar Station of the TVA will be equipped with Ljungstrom Air Preheaters . . . . . .

Construction of the new Watts Bar 180,000 kw. steam power station of the Tennessee Valley Authority is now being rushed to completion. Two of the three 60,000 kw. units are scheduled for February operation. Though supplementary to water power in ordinary times, they will operate as a base-load station during the Emergency.

Each of these units is designed for 600,000 lb. of steam per hr., at 900 lb. per sq. in. and 900° F. total temperature. Each is equipped with a Ljungstrom Air Preheater as an important element in obtaining maximum heat recovery. At capacity operation, gases enter the preheater at 665° F., leave at 328° F., heating combustion air to 553° F.

• • • • •

When the Watts Bar Station was designed, reduced installation time and assured operating continuity were essential objectives. "Major equipment was selected from proved designs", according to a report of the engineers responsible (see *Mechanical Engineering*, Nov., 1941, p. 773). As in many similar cases — Ljungstrom Air Preheaters were chosen.

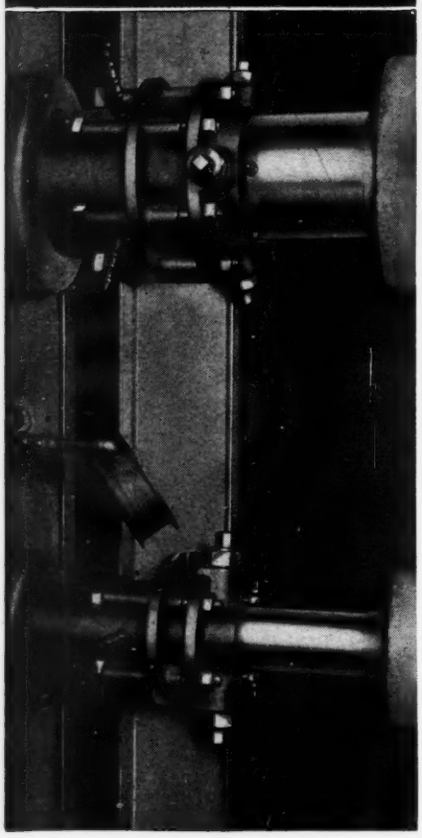
These continuous counterflow units save space and save steel. The high efficiency they reveal in thermal calculations is matched by the high dependability they provide on the job. Service records on outstanding industrial and utility boiler installations throughout the country establish their overall benefits in the economic balance. Every leading boiler manufacturer has installed Ljungstrom's on steam generating units within the past year.

It's more than likely that one or more Ljungstrom Preheaters are now in service on installations similar in capacity and type to one that will meet your own conditions. We'll be glad to give full information on its practical performance. Write us today.

THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd St., New York, N. Y. **Plant: Wellsville, New York**

YARWAY
GUN-PAKT
EXPANSION
JOINTS



Big Automobile Company Uses 67 Yarway Joints

First purchased 3 years ago. Reordered 7 times to present total of 67 Yarway Gun-Pakt Joints, ranging in size from 3 in. to 14 in.

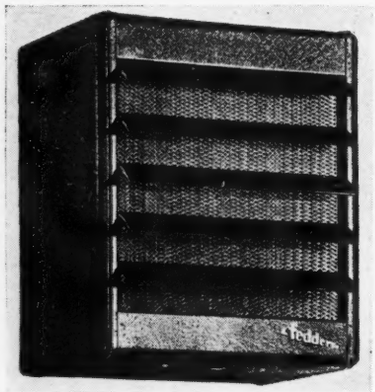
Why don't you select the Expansion Joint that is packed under full steam pressure. A twist of a wrench forces a special semi-plastic packing into the stuffing box by means of integral pressure guns. No need to remove old packing. New packing rejuvenates the old. No need to shut off steam. Write for Catalog EJ-1907.

YARNALL-WARING CO.
100 Mermaid Ave., Phila., Pa.

trip overcurrent relay is also provided to remove test voltage in case of test-peak failure. Test voltage is regulated by a control knob operating a variable-voltage transformer to give smooth potential rise. A pushbutton control station in the handle of one test lead facilitates rapid production testing. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

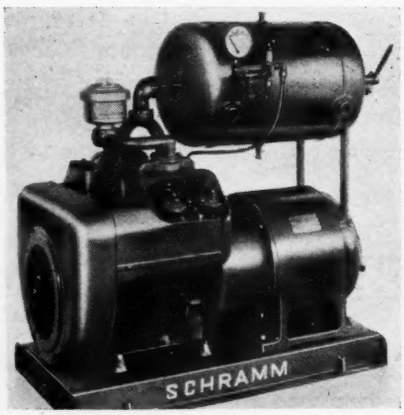
Unit Heaters

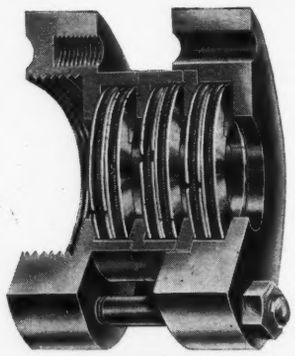
SERIES 4 LOW-TEMP UNIT heaters announced by company. Performance characteristics include ideal conditions of low final temperature, combined with large cfm and long-range heat distribution. Streamlined tubes and latest wide-blade fans result in quiet operation. Units are designed to operate on steam pressures up to 150 lb, and the line is built in twelve capacities ranging from 75 to 1,200 EDR. *Air Conditioning Division, Fedders Mfg Co, Inc, Buffalo, N. Y.*



Compressor

MODEL 50 COMPRESSOR, a small compact unit, has wide applications in manufacturing plants, foundries, and for emergency and standby service. Includes mechanical intake valve, long-life discharge valve, multi-cylinder construction with smooth vibrationless operation, with no foundations required. Special attention has been given to accessibility





What Is the Life of FRANCE METAL PACKING

City of Erie, Pa. Waterworks: "The France Packing in a Holly pumping engine has been in service *32 years* and is still working satisfactorily."

Illinois Power & Light Corp., Champaign, Ill.: "France Metal Packing used on our engines for *27 years* and is still working under a pressure of 170 lbs. superheated. . . . will in all probability outlive us."

Worcester Gas Light Co., Worcester, Mass.: "France Packing has always been tight. . . . Same compressor packed with ordinary packing required a large amount of labor to keep the stuffing boxes tight."

You can't expect more—why accept less?

FREE

44-page Catalog of useful and valuable information. Write for your free copy of Catalog M-7, with facts on

- **Packing Designs for any Service**
- **Installation Procedure**
- **Methods of Lubrication**
- **Pressures and Temperatures**
- **Oil Return and Stripping Rings**
- **Handy Reference Tables**

Request France Engineers to analyze your packing requirements. There is a representative close at hand.

THE FRANCE PACKING COMPANY
Tacony Philadelphia Penna.
Branch Offices in Principal Cities

Original FRANCE METAL PACKING

Put in these new

WEAR-RAID DEFENSES

on all small lines up to 2 inches

Break up the usual raids of small-valve troubles, repairs and replacements. Put in a full force of Chapman 960's that have an *exclusive, special armor against wear:* Interchangeable stems, wedges and seat-rings of super-hardened stainless steel. No other similar valve can live so long.

Chapman List 960's are made in sizes up to 2", and in outside and inside service models (both with threaded ends.) Made to stand pressures up to 800 lb. at 750° F., and cold working pressures up to 1500 lb. Get in touch today with the Chapman plant or the nearest Chapman office or warehouse.

The CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

CHAPMAN LIST 960

Forged Steel Gate Valves

Keep Tryin' - Keep Smilin'
Remember
JOB NO. 1 IS TO
WIN THE WAR

★ ★ ★

Guns, planes, ships, tanks, food and supplies come FIRST as Uncle Sam's forces fight to victory.

That's why Viking production today is devoted largely to War demands. Every day scores of Viking Rotary Pumps are rushed to completion and shipped out to help with vital War production work from coast to coast. That's why, much as we regret it, sometimes we are unable to give usual prompt Viking service on orders received from valued customers in non-defense industries.

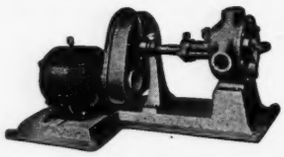


Figure 12—Viking's standard motor drive with relief valve on head; capacities 5 to 90 GPM. Efficient and dependable.

To help you get utmost delivery from your present pumps, the Viking Service Manual explains and illustrates correct installation . . . how pumping efficiency may be stepped up . . . how some repairs and replacements may be avoided. It's free. Write for your copy today.

★ ★ ★

VIKING
PUMP COMPANY
CEDAR FALLS, IOWA

of various working parts that do not require cooling or running water. Illustration shows direct-drive unit with overhead tank. *Schramm, Inc, West Chester, Pa.*

Colorimeter

LUMETRON MODEL 400 FEATURES portability, simplicity of operation, and low price. Built in a wooden housing with cover and carrying strap so as to be used in laboratory as well as plant. Readings are definite and independent of judgment of the operator, and no standard solutions are required at any time in routine work. Operates from any ac or dc 110-volt outlet, and is claimed to be exceedingly simple in operation. *Photovolt Corp, 95 Madison Ave, New York, N. Y.*

Blackout Glue

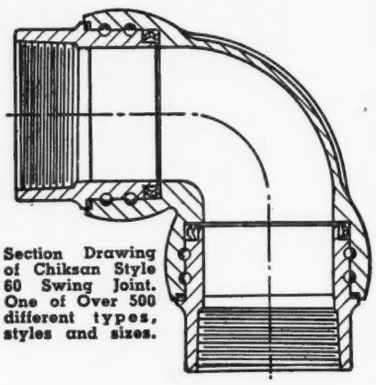
No. 222 BLACKOUT GLUE can be applied with a brush or sprayed, and gives permanent waterproof bond. The blackout procedure is best accomplished by first painting with a black paint and then applying the glue to windowpane and adhering waterproof paper, cardboard, fibre, or some such material. In this way the glue will also act as a shatterproofing agent in the event of bombings. *Midland Glue Products Co, 1488 Madison Ave, Detroit, Mich.*

Generators

COMPANY OFFERS STREAMLINED, revolving-field, ac generators. These are available in sizes from 7½ to 75 kva, 4, 6 or 8 pole, 1800, 1200, or 900 rpm, 60 cycle, for belt or coupling drive or flange mounting. They are available for continuous duty in isolated plants or to supplement other available power supply. Units are built to meet AIEE and NEMA voltage regulation standards. An automatic voltage regulator is generally used for best lighting service where the load fluctuates through a wide range. They can be designed for

Rx To make your hose last longer:
Be sure the CONNECTION is FLEXIBLE, too!

Increase the life of your rubber or metal hose by using CHIKSAN *Ball-Bearing* Swing Joints for connections. They permit easy turning in any direction without placing extra strains on the tubing. Hose cannot kink at connections. Shorter lengths can be used. Savings in hose cost will more than pay for the Chiksan Swing Joints Used.



Section Drawing of Chiksan Style 60 Swing Joint. One of Over 500 different types, styles and sizes.

NOTHING TO TIGHTEN OR ADJUST

CHIKSAN Swing Joints turn on double rows of steel balls which carry all radial and thrust loads and maintain perfect alignment of moving parts. Full 360° rotation in 1, 2 or 3 planes. Unobstructed inside diameter permits full flow of liquids, vapors or gases.

FOR SUCTION, PRESSURE OR VACUUM LINES

Special Packing Unit in High Temperature (Steam Type) Joints is impervious to chemicals injurious to rubber or synthetic compounds.

FOR HIGH AND LOW PRESSURES AND HIGH TEMPERATURES

Made in suitable materials for pressures from 300 to 3,000 pounds, and temperatures to 700° F. Sizes from ⅜" to 12".

Write for Latest Chiksan Catalog

REPRESENTATIVES IN PRINCIPAL CITIES
DISTRIBUTED NATIONALLY BY CRANE CO.

CHIKSAN TOOL COMPANY
CHIKSAN
BALL BEARING SWING JOINTS
for ALL PURPOSES
BREA, CALIFORNIA

Purring like a kitten today—
BUT RUST MAY STRIKE TOMORROW!
Right now rust can be working on the delicate governor mechanisms of your turbines . . . then without warning—trouble! To help prevent costly shut-downs and overhauls change over your turbines to *new* Shell Turbo Oil—it can prevent rust! The first turbine oil to meet all 3 vital requirements of modern turbine lubrication, it offers
RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY
Why accept less? Call in Shell today!
Keep YOUR turbines humming with
SHELL TURBO OIL
SHELL

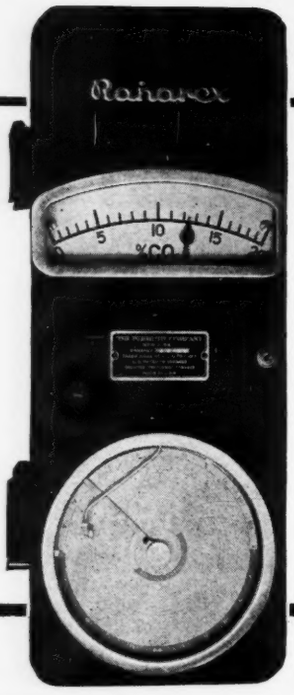
24 HOURS, 7 DAYS? Ranarex can take it!

The only mechanical

CO_2 INDICATOR and RECORDER

This sturdy watchdog of combustion efficiency can stand the heaviest strains. It contains no chemicals or fragile parts to break down . . . yet it gives instant readings within 3/10 of 1% CO_2. Cuts fuel waste as much as 20%.

Ranarex*



FREE BOOKLET from The Permutit Company, Dept. A, 330 West 42nd Street, New York, N. Y. In Canada: Permutit Company of Canada, Ltd., Montreal . . . Toronto . . . Winnipeg . . . Calgary.

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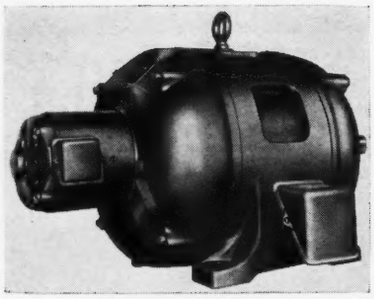


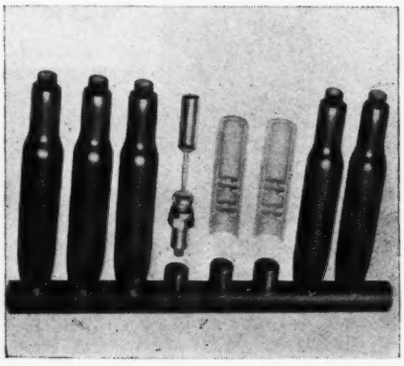
any desired power factor, but the regulation will be governed by the power factor. *Century Electric Co, 1806 Pine St, St. Louis, Mo.*

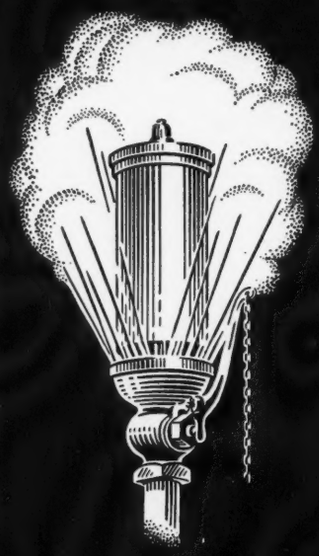
Mixing Chamber

"EVERTITE" CHAMBER is designed especially for easy installation on modern pressure oil storage tanks. Its purpose is to provide a simple, yet effective method of applying blanket of fire-smothering foam to burning oil surfaces. Has an inspection cap that can be removed, and a sealing diaphragm inspected, without releasing tank pressure. The vapor-proof glass diaphragm is installed so as to prevent vapors in oil storage tanks from entering the body of the mixing chamber, from entering and condensing in chemical solution lines, or from escaping to the air when bottom or top plate, or inspection cap, are removed. Diaphragm holds gas tank pressure, yet ruptures fully under foam pressure at time of fire, allowing free access of foam blanket to burning surface. *American-La France-Foamite Corp, Elmira, N. Y.*

Network Connector

INSULATED CONNECTOR is for use in the junction or limiter boxes of industrial secondary networks. The connector, a special Burndy Mole equipped with Molimiters, provides a simple and compact means of interconnecting the ties of the network, joining the ties to the network transformers, and tapping off any number of loads. To isolate faulty ties, or faults in any of the joining cables, each outlet is provided with an easily installed fusible element (Moli-





NO STOPPING NOW!

The intelligent care of turbine or hydro-electric oil will prevent costly breakdowns and interrupted service.

The intelligent care of oil means keeping all dirt and contamination out.

The surest, safest way to keep all dirt and contamination out of turbine or hydro-electric oil is to install a Honan-Crane "Continuous" Oil Purifier.

The Honan-Crane "Continuous" Oil Purifier is backed by twenty years of research and actual experience . . . its performance is guaranteed.

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Write for bulletin 300TP for complete information on the purification of oil for Steam Turbines and Hydro-Electric Generators.

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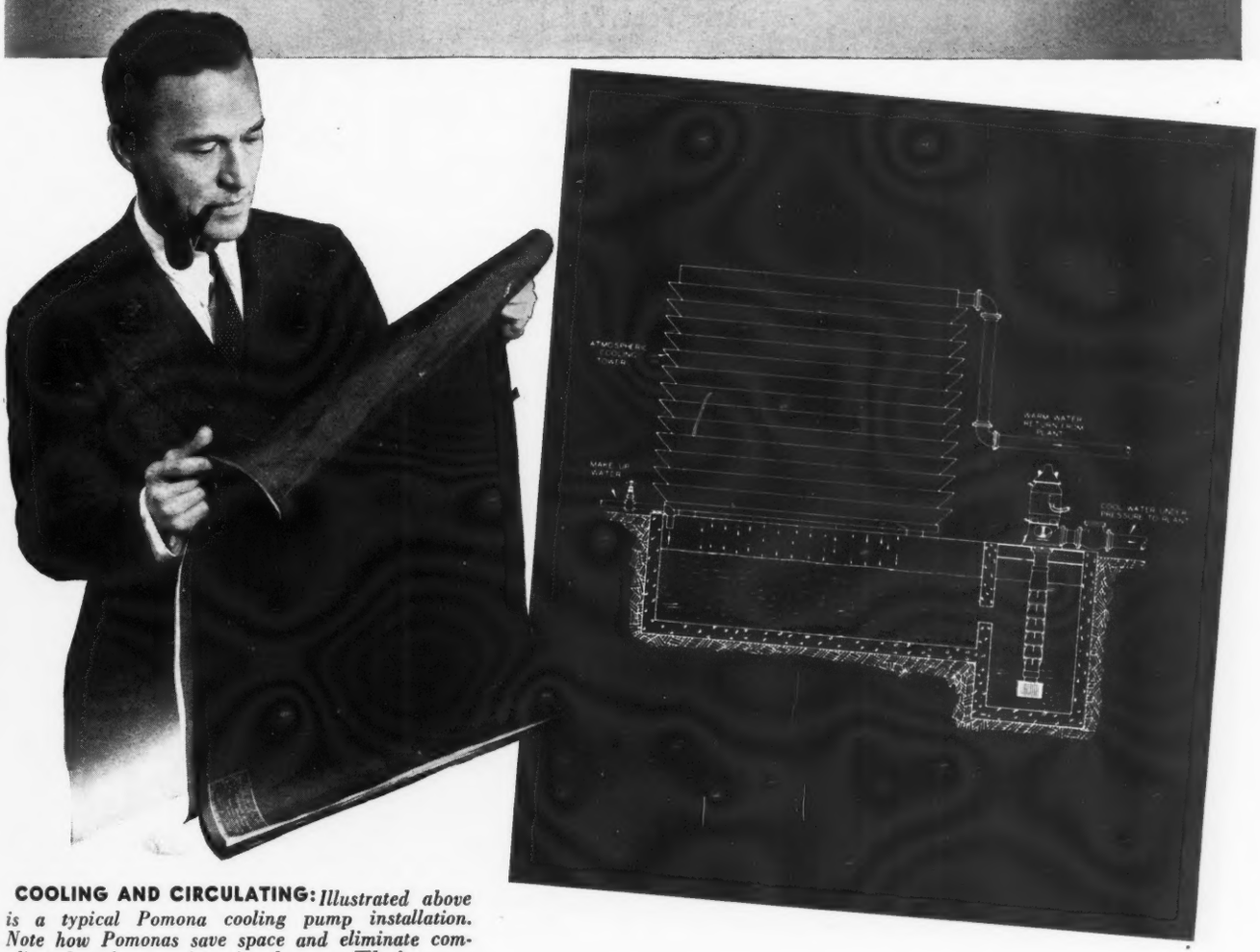
OFFICES IN PRINCIPAL CITIES

LEBANON, INDIANA

ADVANCED IN ENGINEERING AND DESIGN

THIS IS NO TIME TO WASTE POWER ...NO TIME FOR PLANT SHUTDOWNS



COOLING AND CIRCULATING: *Illustrated above is a typical Pomona cooling pump installation. Note how Pomonas save space and eliminate complicated and expensive pipe layouts. What's more, they are easily adjustable for varying head requirements with proportionate savings in power . . . they may be installed in the open without need for housing — in basements, on roofs, over tanks or reservoirs — wherever is most convenient . . . and, because they are lubricated by the water being pumped, constant care and attention is eliminated.*

And here's Pomona's answer!

AMERICAN INDUSTRY today is on an all-out production basis. This is no time to waste power with inefficient pumps . . . or to risk costly plant shut-downs with inadequate equipment.

And there's no need to . . .

Today, through a revolutionary new development, economical Pomona Pumps can handle conditions heretofore considered beyond the sphere of vertical pumps . . . can handle them *more* efficiently, in *less* space, at *lower* maintenance costs and with *longer* service life!

Regardless of the type or character of your pump equipment needs, find out *now* what this great new Pomona development—*"bulbous vane" pumps*—can mean toward the efficient solution of your fluid-handling problems. Distributors in every major center are staffed and equipped to respond to your call . . . or write direct asking for complete engineering details.

POMONA
Water-Lubricated
PUMPS

POMONA PUMP CO., 120 Broadway, New York City. Plants at 4301 So. Spring Ave., St. Louis, Mo. and 206 Commercial St., Pomona, Calif.

E-X-P-A-N-D
BOILER CAPACITY
with
HENSZEY
CONTINUOUS BLOWDOWN

How to get more power from existing equipment is the big problem today! Solve that problem in your plant by installing Henszey Continuous Blowdown.

The Henszey system increases boiler efficiency by eliminating priming, foaming, and, with simple chemical treatment, scale. Yes, eliminates them by eliminating high boiler water concentrations—the most frequent cause of these common boiler troubles. The Henszey system continuously and automatically removes trouble-making impurities without the heat loss of ordinary intermittent blowdown.

The advantages of Henszey Continuous Blowdown extend beyond the boiler itself. A clean boiler with clean water produces clean steam-free from the corrosive particles of carryover. Equipment all along the line will work more efficiently for longer periods of time with a minimum of shutdowns for repairs or replacements.

We will gladly make an analysis of the boiler water problems of your plant to show you how proper control of boiler water concentration can increase all-over power capacity. Remember, Henszey can furnish you with any type of system—tailored to your particular problem.

Write us today

HENSZEY COMPANY
Dept. D3 **Watertown, Wis.**

HENSZEY
POWER PLANT SPECIALTIES

miter) inclosed in an arc-proof chamber. The assembly is furnished with any specified amount of outlets, and the design can be modified to suit individual needs. *Burndy Engineering Co, Inc, 107 East Blvd, New York, N. Y.*

Pneumatic Foot Pedal

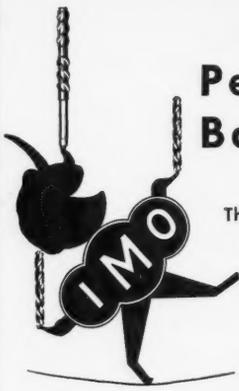
SCHRADER PNEUMATIC FOOT PEDAL cuts operator's effort in operating pneumatic machines. Pedal can be operated with either foot, and is portable and permits various angles of approach. Where work necessitates standing away from the machine, the pedal can be brought out to allow practical operation in an erect position. *A Schrader's Son, 470 Vanderbilt Ave, Brooklyn, N. Y.*

Grease Solvent

GUNK X-11 IS AVAILABLE as a concentrate, which may be diluted with a grease solvent before used to charge large open cleaning tanks or vats. The new cleaning method is carried out by cold immersion of greasy or dirty parts. The new solvent, it is said, not only takes out the cling out of hard mineral dirt and grease accretion, but emulsifies them so that they may be instantly and completely rinsed away by sluicing with water. *The Curran Corp, Malden, Mass.*

Strainers

SUPPLEMENTING REGULAR LINE OF PUMPS and accessories, company has issued a series of strainers for pipe sizes from 1 to 6 in., which incorporate in their design a number of improvements over the conventional strainer. While designed primarily for use in the company's rotary pumps, they are just as well suited to applications with all types of pumps, or wherever a strainer is required in a piping layout. The basic design follows that of the standard "bucket strainer". The bodies are made of iron as standard, and are available in bronze. Steam-jacketed bodies can also be furnished. The strainers are rated on a basis of flow in gpm, and are furnished in five sizes from 50 to 750 gpm. The 50-gpm strainer has tapped connections; the larger sizes have flanged connections. *Blackmen Pump Co, Grand Rapids, Mich.*

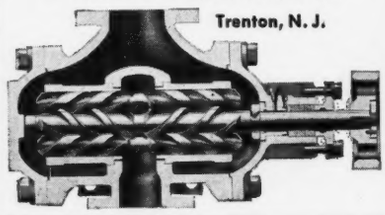


Perfect Balance

The three moving parts of the
De Laval-IMO Oil Pump
are in perfect rotational balance and the pump can be coupled to a standard-speed motor or turbine. The delivery is smooth and pulsationless, which is highly desirable in fuel oil-burner, lubrication and hydraulic pressure service.

There are no gears, no bearings, and only one packing box, the latter subject to suction pressure. IMOs are supplied for all capacities and all pressures. Ask for Catalog I-83.

IMO PUMP DIVISION
of the De Laval Steam Turbine Co.
Trenton, N. J.



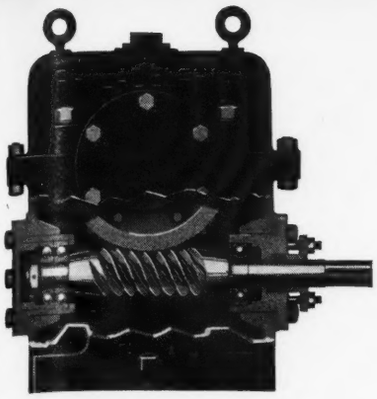
HENSZEY
BOILER FEED
REGULATORS

The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

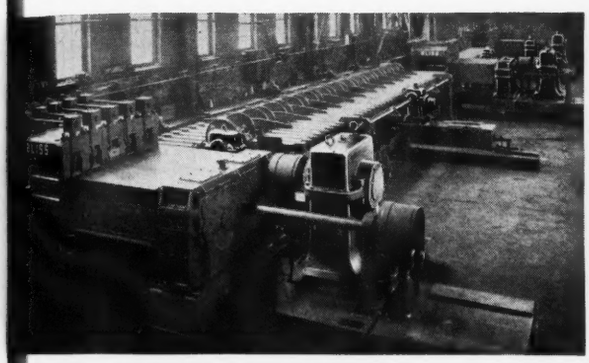
These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary — nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

HENSZEY COMPANY
Dept. D3—Watertown, Wis.



Philadelphia Worm Gear Units are made in both horizontal and vertical types and in a wide range of horsepowers and ratios. They're designed right, they're built sturdy. Write today for full details.



group of Philadelphia Worm Reducers installed on steel mill uipment.

For years Philadelphia Worm Gear Speed Reducers have proven their dependability by operating in almost all lines of industry, under practically all conditions without giving trouble. They have a reputation for satisfaction that's based on actual performance. Today, when your hard pressed production schedules depend so much on the steady operation of all your equipment, be sure to pick the drive that has stood the test of time . . . insist on Philadelphia Worm Gear Reducer.

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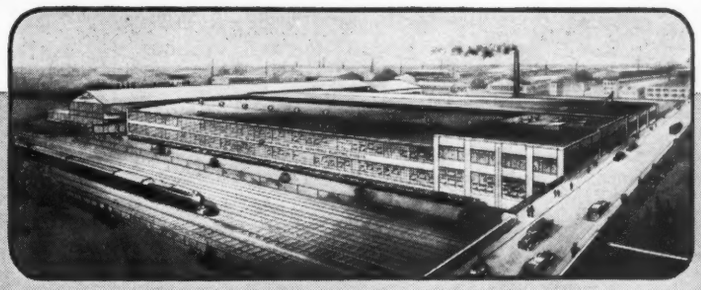
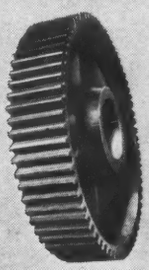
INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET PHILADELPHIA, PA.
New York, Pittsburgh, Chicago



***Philadelphia* LIMITORQUE CONTROL**
operates all types of valves, etc., safely, economically, from convenient stations.



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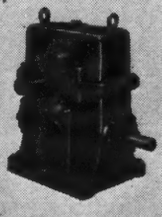
All types and sizes of industrial gears. Can be supplied in all materials.



***Philadelphia* WORM GEAR SPEED REDUCER**
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

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The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

***Philadelphia* HERRINGBONE SPEED REDUCER**
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

"LOOK AT THE WHOLE SYSTEM" of automatic temperature control! When the JOHNSON system is employed, each device functions perfectly as part of the complete installation. "*Jeweled Movement*" controllers, including thermostats and humidostats for a variety of uses, Modulating Valves, Long-travel Damper Motors, and Modulated Action for thermostatic expansion valves are distinctive devices in the Johnson line.

There's a war on! There must be no bogging down in the production rate of American industries. Only when temperatures and humidities are maintained at proper levels can certain manufacturing operations be carried on successfully, without "shut-down losses". Aircraft engines, powder, shells, and guns are just a few implements of war which must be made under precise conditions. Minute parts must be measured with temperature-calibrated instruments. In other cases, the humidity must be just right.

The nation-wide Johnson organization, backed by research and production in the Johnson factory, furnishes and installs automatic temperature and humidity control for just such purposes. Ask for bulletins describing Johnson control, or call a Johnson engineer from a nearby branch office. There is no obligation, of course.

JOHNSON
Automatic TEMPERATURE AND AIR CONDITIONING *Control*
JOHNSON SERVICE COMPANY, MILWAUKEE, WIS. & BRANCHES IN PRINCIPAL CITIES

New Power Construction

Construction to Come

Calif., Permanente — Interests represented by H J Kaiser, Latham Square Bldg, Oakland plans constructing (2nd unit), magnesium plant expansion. $11,000,000. RFC loan.

Calif., Wilmington—Bids about Feb 1, by Los Angeles Bureau Power & Light, 209 S Bway, Los Angeles constructing 80x120-ft control house, Harbor Steam Plant, 100 S Lagoon Ave, $150,000; bids latter part March, superstructure Unit 1, Harbor Steam Plant, 100 S Lagoon Ave, $300,000.

Conn., Bridgeport—Bids Feb 5, by City, Pub Works Dept, City Hall, constructing sewers, sewage pump, station, etc, Evers Lane. Docket Conn 6-107. $35,000 DPW. Henry L Rowland, city engr J A Weimann, 3018 Main St, engr H K Oatley, 26 Oakview Ave, Maplewood, N. J., consult engr.

Conn., Bridgeport—United Illuminating Co, 1155 Broad St, plans nearing completion by L J Ulianelle; 139 Orange St, New Haven, and takes bids soon constructing steam power-generating plant, Steel Point Station. $550,000. Westcott & Mapes, Inc, 139 Orange St, New Haven, engrs.

Conn., Middlebury — Waterbury Clock Co, 31 Cherry Ave, Waterbury, plans constructing brick factory, incl power house, air conditioning system. $550,000. L F Caproni, 1221 Chapel St, New Haven, engr.

Ga., Columbus—Comrs Roads & Revenues, Muscogee Co, plans constructing booster pump station, elevated storage tank, Bealwood Area, Docket Ga. 9-186, $14,450. DPW.

Ill., Decatur—Illinois-Iowa Power Co, Decatur. A Van Wyck, pres, plans constructing steam generating plant, Illinois River.

Ill., Lockport—Texas Co, 332 S Michigan Ave, Chicago, plans constructing plant addn. $2,000,000.

Ind., Bloomfield—Utilities Dist of Western Indiana Rural Electric Membership Corp, Bloomfield, plans constructing generating plant. $370,000 REA allot.

Ind., Fort Wayne—City, O H Adams, city supt, plans municipal power plant imprvs, boiler room addn, new boiler, etc. $250,000.

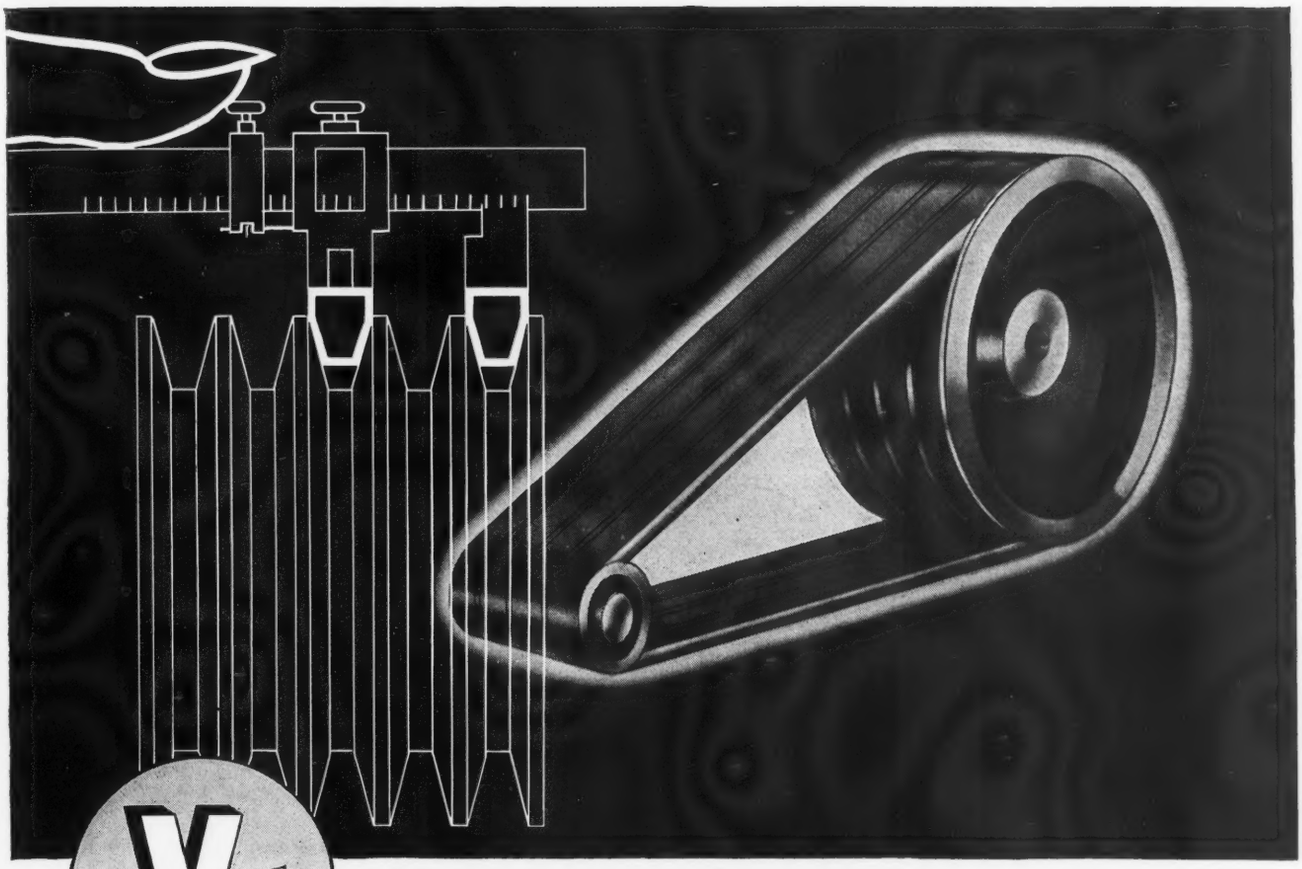
Ind., Fort Wayne—City plans constructing power substation, southwestern part city. $50,000 or more with equip.

Ind., Indianapolis — Curtiss-Wright Corp, 30 Rockefeller Plaza, New York, N. Y., plans by Albert Kahn & Associates, 345 New Center Bldg, Detroit, Mich., constructing aeroplane mfg plant. $2,500,000.

Iowa, Slater—Bids Feb 24, by City, P Rood, city clk, constructing power plant, $65,000 total. R W Gearhart, 349 21 St SE, Cedar Rapids, engr.

La., Minden—Bids Feb 2, by City, for generating unit, etc, power house exten for light and water plant.

La., Monroe—City, c/o W H Rodrigues, comr Finance and Utilities, Monroe, plans constructing power plant addns, turbo-generator, condenser, switchgear, $325,000; turbine room, boiler house, $80,000-$90,000. Burns & McDonnell, 107 W Linwood Blvd, Kansas City, Mo., engrs.



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THE DOMINANT DRIVE OF INDUSTRY

TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence — the result of cooperative engineering, research and experience.

minimum tolerances — maximum performance

The smooth, quiet functioning of Multiple V-Belt Drives, transmitting their full and uniform flow of vibrationless power, has come to be taken for granted. Which, of course, is at it should be. But there is more to such performance than meets the eye. . . . Before "The Dominant Drive of Industry" reached its present state of perfection, it was discovered that ordinary engineering and manufacturing standards were inadequate. Laboratory experiments and field studies over a period of years indicated the necessity for absolute uniformity of groove dimensions — depth, diameter and spacing, as well as uniformity in belt cross sections with minimum allowable tolerances. From these findings, new, high standards were set up and adopted by association members. . . . The result is that today, industry is assured of maximum performance and long, trouble-free service from Multiple V-Belt Drives.

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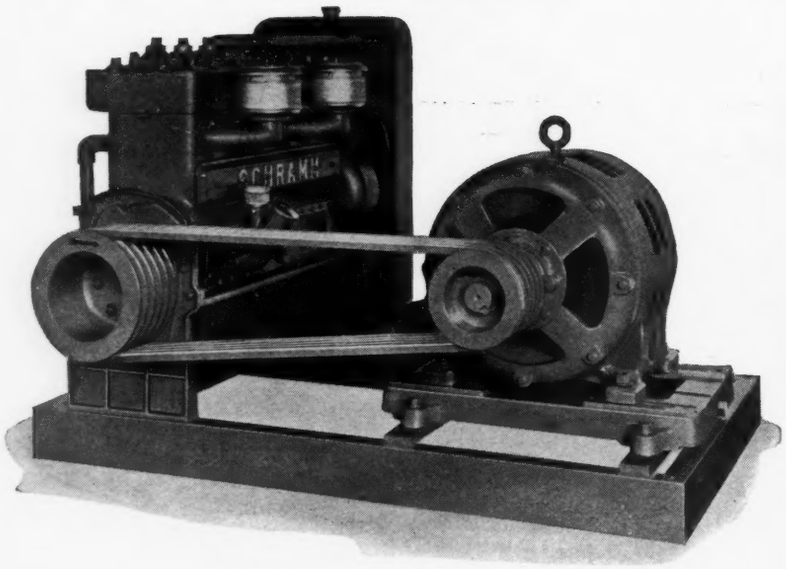
140 SOUTH DEARBORN STREET • CHICAGO

AIR for DEFENSE



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"V" BELT DRIVE

A UNITED NATION puts its shoulder to the wheel. Every State, City, Town and Industrial Plant is organizing to further combat and protect its People from the "agencies of destruction."

The Contribution of SCHRAMM, INC. to this tremendous Defense Plan consists of special combinations of compressed AIR POWER for operating machinery, air raid and fire sirens, tools for demolition, rescue and repair work, plant maintenance and power plant auxiliary units.

Industrial plants are working at their maximum capacities and need additional compressed air for expansion and protection against interrupted power service.

Makes no difference if your air requirements are in the shop or out in the yards, or where extension of air lines would be impractical and expensive—Engine Driven Auxiliary Units will give you "AIR WHERE YOU NEED IT," instantly—at low cost.

Built in Sizes 20 to 600 cu. ft. Displacement.

Write for Bulletin #4260

SCHRAMM, INC., WEST CHESTER, PA.

Md., Cheltenham — Cheltenham School for Boys, Cheltenham, soon lets contract constructing brick, concrete boiler house addn. $50,000. Kea, Ross & Walton, Hyattsville, archts. J Posey, Baltimore Trust Bldg, Baltimore, engr.

Md., Sparrows Point (Nr Baltimore)—Bethlehem Steel Co, bids soon constructing water treatment plant, pump sta, sludge tanks, etc. $250,000. Whitman, Requardt & Smith, W Biddle and Charles Sts, Baltimore, engrs.

Mass., Fall River—Bids Feb 11, by City, Water Works Dept, City Hall, constructing water system, Contr 1, pump station, diesel engine and pump; Contr 2, 42 in pipe line, Lake Noquocke-Darmouth to Watuppa Pond, Docket Mass, 19-101. $410,365. Hayden, Harding & Bichanan, 622 Park Sq Bldg, Boston, engrs.

Mass., Norfolk — Commonwealth of Mass., Dept Public Health, Dr Paul J Jakmauh, comr, State House, Boston, plans nearing completion constructing power house addn, equip, Pondville State Hospital. $110,000. Francis W Mahoney & Assoc, 177 State St, Boston, engrs.

Mich., Wyandotte—Firestone Metal & Rubber Products Co, Wyandotte, plans constructing boiler house, plain fdn. $50,000. Russell Eng Co, 607 Shelby St, Detroit, engrs.

Mo., Kennett—Bids Feb 10, by city, for diesel engine and generator for power plant. $50,000. Burns & McDonnell, 107 W Linwood Blvd, Kansas City, Mo., engrs.

Nev., Las Vegas—M A Hanna Co, Leader Bldg, Cleveland, O., plans constructing manganese mill near here. $4,500,000.

N. J., Camden—Pub Serv Electric & Gas Co, 80 Park Pl, Newark, plans constructing Camden Switching Station addn with transformers, etc. $350,000. F P Fairchild, 80 Park Pl, Newark, engr.

N. J., Elizabeth—Pub Serv Electric & Gas Co, 80 Park Pl, Newark, plans constructing electrical switching station, incl brick, steel bldgs, equip, Bayway. $1,300,000. F P Fairchild, 80 Park Pl, Newark, engr.

N. J., Hoboken—Tietjen & Lang Dry Dock Co, 1 Bway, New York, N. Y., plans by Kelly, Syska & Hennessy, archts and engrs, 144 E 39 St, New York, N. Y., constructing steel electrical substation, at shipyard.

N. J., Jamesburg—City plans constructing sewage treatment plant, sludge beds, filter beds, pump house, tanks, etc. $82,812. WPA. J. H. Weitzen, Smith and Hobart Sts, Perth Amboy, WPA engr.

N. J., Jersey City—Pub Serv Electric & Gas Co, 80 Park Pl, Newark, plans constructing boiler house, boilers, West End Gas Works. Over $40,000.

N. J., North Brunswick—Pub Serv Electric & Gas Co, 80 Park Pl, Newark, plans constructing substation. Over $40,000. F P Fairchild, 80 Park Pl, Newark, engr.

N. Y., Brooklyn—Robins Dry Dock & Repair Co, Erie Basin, plans by Kelly, Syska & Hennessy, 144 E 39 St, New York, constructing compressor room, electric transformer substation, motor generator station, tool room, etc. $50,000.

N. Y., Brooklyn—Yards & Docks, Navy Dept, 18 St and Constitution Ave, NW, Wash., D. C., plans by Kelly, Syska & Hennessy, 144 E 39 St, New York, constructing transformer substation, pump room, motor generator room, tool and riggers room at 588-742 Columbia St. $40,000.

N. Y., New York—Dept Public Wks, Municipal Bldg, plans constructing hospital, Institute of Forensic Medicine, Manhattan Boro, $500,000; replacing boilers,

EXACT CONTROL IS *Vital*..

— to maintain consistently uniform quality in the manufacture of Globe Steel Tubes. A large and fully equipped chemical and physical laboratory, manned by graduate metallurgists, is basic to the exact control of production maintained at Globe Steel Tubes Co.

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In addition to the most advanced machinery and methods in the mill, under the direction of a large staff of experienced engineers and technicians, the Globe Steel Tubes Co. laboratory is another important factor which contributes substantially to the inherent quality of Globe Steel Tubes . . . quality which has won them high recognition with utilities, leading railroads, industrial and marine boiler builders.

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STAINLESS TUBES • BOILER TUBES • CONDENSER AND HEAT EXCHANGER TUBES • MECHANICAL TUBING . .

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Accuracy to Millionths of an Inch with

The parts for tanks, planes and guns, produced in thousands of separate plants, can only fit together properly if made in standard sizes, to accurate gages. Pratt and Whitney secure accuracy to millionths of an inch by finishing their Hoke precision gage blocks in this air conditioned room at West Hartford, Connecticut.

Standard conditions of 68° F. and 50% relative humidity are maintained, 24 hours a day the year 'round, with Frick Equipment. This working space, covering 16,800 sq. ft., is believed to be more accurately controlled than any other of like size in existence. Full credit is due the Automatic Refrigerating Co., Frick Distributors at Hartford.

Put your air conditioning problem up to the experts who have nearly 60 years' experience back of their recommendations. Write **Frick Co., Waynesboro, Pa.**

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Reg. U. S. Pat. Off.

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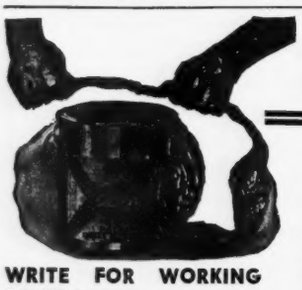
Self-Locking Nut!

The built-in, self-energizing locking ring springs to life as soon as any backing off tendency asserts itself and holds the nut in place.

Send for details today. STANDARD PRESSED STEEL CO. BOX 577 JENKINTOWN. PA.



Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. *All* needs are supplied by one packing when you use "AMBEST."

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WRITE FOR WORKING SAMPLE Eureka offers Flax, Asbestos, Rubber and Metallic Packings for all purposes. Send for 36 page catalog.

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

Riverside Hospital, Bronx Boro, $335,900; garage, storehouse, Lincoln Hospital, Bronx Boro, $133,200.

N. Y., St. George (sta Staten Island)—Dept Docks, Pier A, North River, New York, plans reconstructing machine shop and boiler room, St George Ferry Terminal. $300,000.

N. Y., Olean—N H Fuller, supt Water Dept, City Hall, bids late in February or early in March, constructing diesel power plant, incl 350- to 400-hp generator, at filtration plant. $22,000. C H Weatherell, Jr, city engr.

Ohio, Lima—Ohio Steel Fdry Co, J Galvin, pres, Lima, plans constructing plant addn, for War Dept. $2,000,000.

Pa., Pittsburgh—Div Defense Housing, FWA, 811 Vermont Ave, N W, Wash., D. C., bids soon constructing sewage pump station, 2,500 ft 6 in force mains, Harrison Twp, Chester Engineers, 210 E Parkway, N S, engrs.

Pa., Slater—Bids Feb 24, by P Rood, city clerk, constructing power plant, equip, dist sys. $65,000. R W Gearhart, 349 21 St, S E, Cedar Rapids, engr.

Pa., Tarantum—Boro Council, H H Girt, secy, 304 Lock St, Contr 1, removal, disposal existing turbo-generator condenser, vacuum pump, etc. Contr 3, constructing pit, and fdns for 1500-kw turbo-generator and condenser, lds for 50 kw dual-driven exciter set, installing ventilating system for generator, etc. $90,000. Morris Knowles, Inc, 1312 Park Bldg, Pittsburgh, engr.

Tenn., Clarksville—Bids about Feb 10, by U. S. Eng, 306 U. S. Court House, Nashville, constructing Kentucky-Tennessee Armored Division, Camp bldg, utilities, water, sewers, electrical distr sys, roads, etc, near here.

Texas, Baytown—Humble Oil & Refining Co, Baytown, Texas, plans constructing new plant. Reconstruction Finance Corp will finance.

Texas, Dallas—Magnolia Petroleum Co, Magnolia Bldg, plans constructing plant, vicinity here. $15,000,000. Defense Plant Corp will finance.

Texas, Daingerfield—Southwestern Iron, Steel & Coke Co, c/o W O Irving, pres, National Bank, Daingerfield, plans constructing blast furnace or iron ore smelting reduction plant, between here and Hughes Springs. Approx $28,000,000. Defense Plant Corp will finance.

Texas, Denison—Bids about Feb 15, by U. S. Eng, Citizens Natl Bank Bldg, constructing spillway for Denison Dam. $3,000,000-$4,000,000.

Texas, Denton—Bids Feb 17, by Texas State College for Women, Denton, constructing power plant engine room, turbo-generator unit, etc. Over $40,000.

Texas, Edinburg—A A Aldrich, mayor, bond issue voided, constructing electric power plant and distr sys. $500,000. Project abandoned.

Texas, Houston—Reed Roller Bit Co, Mack St, plans renovating, expanding bldg, facilities. $2,500,000 for bldgs, $6,034,000 equip, etc. Defense Plant Corp will finance.

Texas, Port Arthur—The Texas Co, Port Arthur, plans constructing (synthetic rubber) plant. Reconstruction Finance Corp will finance.

Texas, Port Arthur—Texas Co, 720 San Jacinto St, Houston, revised plans constructing lubricating oil mfg plant, etc. $2,500,000.

Texas, Sanatorium—Bids Feb 17, by State Bd Control, Austin, constructing power plant engine room, 200-kw turbo-

Takes a lot of work off your hands

Power plant men like the Mason No. 11 because it's a steam reducing valve that they can install and forget. Year in and year out No. 11 does its pressure regulating job with almost no attention. When you use these valves, your maintenance men have more time for other important work.

If your present valves need too much attention, check up on the Mason No. 11.

These standard EXTRA DUTY FEATURES reduce your maintenance costs

Hardened Stainless Steel Trim. Pilot valve and main valve hardened to 500 Brinell; seats to 150. Wire-drawing, steam cutting, and valve sticking are practically eliminated.

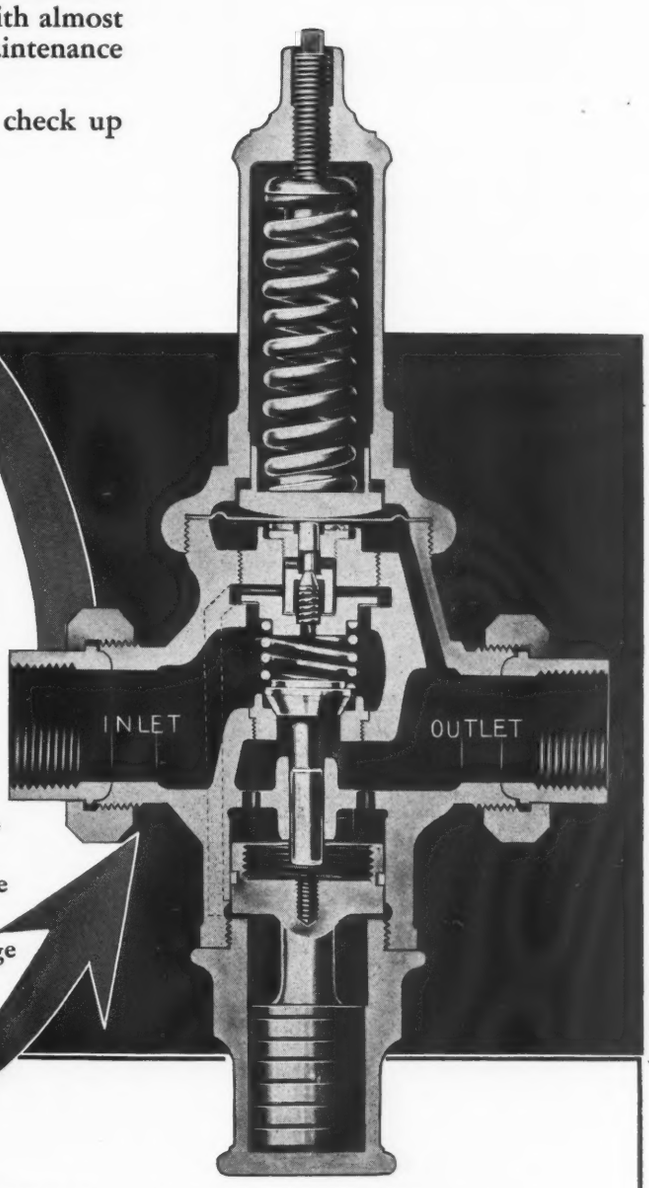
Beaded Diaphragm of phosphor bronze for longer life.

Pilot Operation smooths out the control, avoids cycling and chattering.

Downstream Connection increases valve capacity, insures accurate control.

Wide Range of adjustment without change of spring.

Write for Bulletin No. 69



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in all water, steam and air lines to protect valves, traps, and other equipment from scale and dirt. These strainers are precision made. The screen is held between two carefully machined surfaces; no foreign matter can get by—screen cannot buckle. They cost no more than others. Bronze strainers—¼″ to 1½″. Iron strainers 2″ to 4″.

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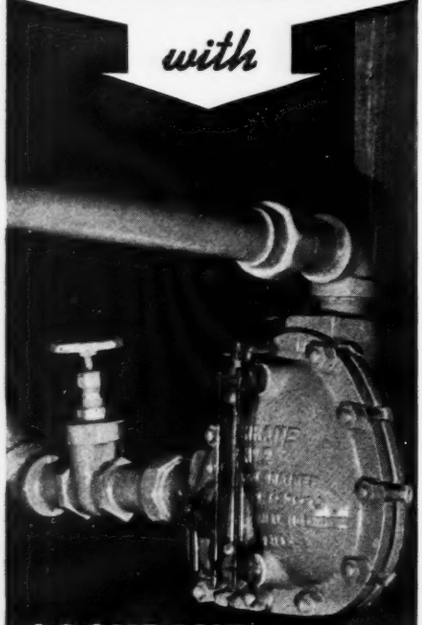
DRAINING
LARGE QUANTITIES OF LOW PRESSURE, DIRTY
CONDENSATE
with



COCHRANE
Multiport
DRAINERS

at S. D. WARREN CO.'s
Cumberland Mills, Maine
• PAPER MILL •

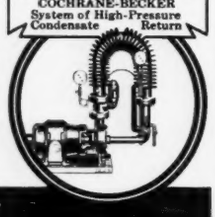
MANY Cochrane Multiport Drainers are in use at the Warren Cumberland Mills plant as they are in many other paper mills. The reason for their satisfactory operation is told by Mr. F. L. Wellcome, steam engineer at this plant: "These traps discharge continuously, the valve opening being determined by the height of water in the float chamber; the larger the volume of water, the larger the valve opening. The rotating movement of the sleeve valve serves to keep the valve free of sludge accumulation."

Write for Publication 2925 on Multiport Drainers

COCHRANE CORPORATION
3106 N. 17th St. Philadelphia, Pa.

Rapidly removes hot condensate from steam process equipment and returns it to boiler at high pressure and close-to-process temperature. IMPROVESQUALITY, INCREASES PRODUCTION, CUTS COSTS.

Ask about the new COCHRANE-BECKER System of High-Pressure Condensate Return



Cochrane

generator unit, etc, for State Tuberculosis Sanatorium.

Texas, Wichita Falls—Bids Feb 10, by U. S. Eng, Citizens Bank Bldg, Denison, constructing laundry, boiler house, etc, Shepard Field.

Washington—Bids Jan 15, by Bureau Reclamation, Custom House, Denver, Colo., for pipe, valves, etc, Grand Coulee Power Plant-Right Powerhouse, Inv D-38, 256-A.

Wash., Spokane—Defense Plant Corp, 811 Vermont Ave N W, Wash, D. C., plans constructing aluminum rolling mill. $10,000,000.

Wash., Vancouver—Bonneville Power Admin, P O Box 3537 Portland, Ore., plans enlarging J D Ross substation by transformer bank, addns to steel structures, other equip, to provide terminal facilities for transmission lines. $1,535,-270. Funds allotted.

Wash., Walla Walla—Bonneville Power Admin, P O Box 3537, Portland, Ore., plans constructing power substation addn. $130,000. Funds allocated.

Wis., Green Bay—Wisconsin Pub Serv Corp, 2nd 30,000-kw turbo-generator unit, Bayside Steam Plant. $2,780,000.

Wis., Oshkosh—City preparing plans constructing pump station, Blackhawk St, 3 ten mgd pumps for Menominee Park, Moore and Blackhawk Sts, and auxiliary pump and motor Lake Dr pump sta. F M Wolverton, city engr.

Wis., Waterloo—Bids Feb 15, by City Water & Light Comn, Waterloo, (revised bids), constructing electric generating plant addn $105,000. Commercial Testing & Eng. Co, 307 N Michigan Ave, Chicago, Ill., engrs.

Contracts Let

Calif., Wilmington—Los Angeles City Dept Water & Power, 207 S Bway, Los Angeles, awarded contract constructing main steam condenser, with condensate pumps for Harbor Steam plant, Spec 4031, to Elliott Co, 1732 E 7 St, Los Angeles. $733,895.

Conn., Bridgeport—United Illuminating Co, 1115 Broad St, awarded contract constructing fdns, tunnel work, manholes, excav, substructure for power plant, Steel Point Plant, E Main St, to C W Blakeslee & Sons, Inc, 58 Waverly St, New Haven, $350,000.

Idaho, Kellogg—Bunker Hill Smelter Co, Kellogg, awarded contract constructing waste heat and power boiler, Babcock-Wilcox, to C C Moore & Co, Smith Tower, Seattle, Wash. $150,000.

Iowa, Des Moines—Iowa Packing Co, E 18 and Maury Sts, awarded contract constructing cold storage bldg, to J S Sweitzer & Son, 615 Minnesota Mutual Life Bldg, St. Paul, Minn. $175,000.

Iowa, Keokuk—Keokuk Electric Metals Co, Keokuk, awarded contract constructing substructure power house, to Cameron Joyce Co, Keokuk. $93,550.

Iowa, Des Moines—War Dept, 20 St and Constitution Ave N W, Wash., D. C., exten plant (product unknown) to Weitz Co, Inc, 713 Mulberry St and McLaughlin Bros, both Des Moines, and Central Eng Co, and Preister Const Co, Amer. Bank Bldg, both Davenport. $8,500,000.

Ky., Louisville—Hycar Chemical Co, c/o The B F Goodrich Rubber Co, 100 W Bway, and Phillips Petroleum Co, Preston and Barnett Sts, awarded contract constructing plant addn, for War Dept, to Batson-Cook Co, Inc, West Point, Ga. Est $2,750,000. Defense Plant Corp will finance.

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says

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WORKING SAMPLE
Try a *trustworthy* packing at our expense! Just send us your name, address and specify service conditions and size of packing.

PALMETTO* PACKING
protects rods, shafts, stems

Palmetto Packing is never guilty of rapid wear . . . because Palmetto is *internally* lubricated. Every strand is thoroughly lubricated with a special graphite grease *before braiding.* Palmetto Packing stays soft, pliable, and lasts longer . . . assures continuous peak production. Make sure of fewer shutdowns for repacking by using Palmetto.

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PALMETTO
for steam, hot water, air.
PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *for acids.* KLERO *for foods, etc.* PALMETTO SUPERSHEAT
PACKINGS

9 out of 10 who try them, buy them

"Retreaded" or the duration

APEXIOR keeps border-line boilers in service indefinitely

Like those precious tires you are retreading for longer service, boiler tubes and drums *must* be guarded for extended operation . . . What man can foresee when new power equipment will be readily available?

Any boiler — now inactive or even nearing condemnation — that can withstand the required hydrostatic test after being cleaned, can be APEXIORIZED and kept in continuous service with reasonable care.

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A Durable, Renewable Surface

APEXIOR No. 1 puts a protective, added wearing surface on bare boiler metal. *This* surface, instead of the metal, takes the beating and resists corrosion — a surface that can be easily renewed with a hand brush or a power coater. Scale cannot bond tightly with an APEXIORIZED surface, brush-cleaning is simple and quick.

APEXIOR Guarantees Good Metal Condition — no other protection offers the same assurance and security

For years, APEXIOR has been used on steam boiler and turbine equipment by men who demand the utmost in power plant protection and efficiency.

Now — if never before — you should investigate the APEXIOR method of keeping old equipment alive, and ensuring maximum service from new installations.

Recommended by all U. S. and Canadian boiler insurance companies

Write for Bulletin 1290

APEXIOR REG U.S. PAT. OFF.

These tubes and the drum metal have been coated with APEXIOR No. 1 by unskilled help in a small plant. They can be cleaned with a wire brush. No new tubes will be needed as long as the coating is maintained.

A single coat re-application every two or three years with a hand or rotating brush will keep this boiler in efficient service for a long time to come.

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

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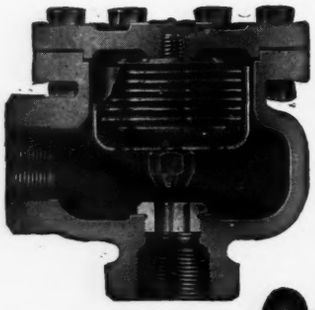
you need **NICHOLSON**

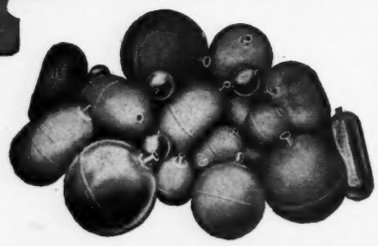
TRAPS ● FLOATS

● CONTROL VALVES



● NICHOLSON TRAPS of the industrial thermostatic type are large in capacity, will not freeze, eliminate air binding, require no adjustment, prevent dribbling, provide intermittent discharge and never water-log. In many cases they step up process production as much as 30%. Pressures from vacuum to 300 lbs. with superheat. Sizes ¼" to 2". Bronze, cast iron, cast steel construction. (Trap Bulletin No. 941)

● NICHOLSON FLOATS are available in all sizes, all shapes for all applications—always dependable! High tensile strength—great external pressure resistance. (Bulletin No. 339)



● NICHOLSON CONTROL VALVES are designed for long life, quick and dependable control of air, steam, oil, gas or water. 2, 3, or 4-way types. (Bulletin No. 140)

W. H. NICHOLSON & COMPANY
125 OREGON STREET
WILKES-BARRE PENNSYLVANIA, U.S.A.

Rely on Nicholson for: Industrial Steam Traps, Piston and Weight Operated Traps, Control Valves, Floats, Flexible Couplings, Expanding Mandrels, Compression Shaft Couplings, Steam Eliminators and Separators, Compressed Air Traps.

A new principle

IN A MAX HAND *and* RE-SETTING DEVICE *used in the* HYDRAULIC GAUGE! . . . .

★ Unlike the ordinary gauge having a max hand carried forward by contact with the pointer . . . In this Model "GHB" Gauge the max hand is carried forward by the gauge movement itself. *There is no drag on the pointer.*

The max hand shows the highest pressure reached; can be easily reset from the *outside* of the gauge, through the case or through the glass.

For details of this and other fine Lonergan safety devices—just write—

J. E. LONERGAN CO.

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Lonergan

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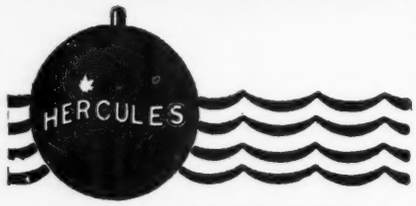
HERCULES

Seamless Copper

FLOATS



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Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

Md., Hyattsville—Washington Suburban Sanitary Comn, H R Hull, ch engr, Owens Ave, will construct Brighton Dam on Patuxent River, force account. Est $1,000,000. Ambursen Co, 295 Madison Ave, New York, N. Y., consult engrs.

Mass., East Boston (Sta. Boston)—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash., D. C., awarded contract constructing fuel storage facilities, Orient Heights, NOY 5195, to Rowland Tompkins & Son, 420 Lexington Ave, New York, N. Y., and James A. Munroe & Sons, North Attleboro, Mass. $3,500,000.

Mass., Waltham—Raytheon Mfg Co, 55 Chapel St, Newton, awarded contract constructing factory, Willow St, to Austin Co, 19 Rector St, New York, N. Y. Est $1,250,000.

Mass., Wrentham—Wrentham Products Co, J W Dowling, Depot St, awarded contract constructing factory with boiler plant wing attached to Walter H Barker, Inc, 23 Main St. Est $100,000. Defense Plant Corp will finance. F Burton Mitchell, 9 Mechanic St, Foxboro, archt and engr.

Mich., Grand Blanc—Fisher Body Div General Motors Corp, Flint, awarded contract constructing industrial bldg, to Darin & Armstrong, Inc, 2041 Fenkell Ave, Detroit. Est $4,800,000. Defense Plant Corp will finance.

Mich., Lansing—City Public Lighting Comn, awarded contract for structural steel frame for power plant addn, to R C Mahon Co, 8650 Mt Elliott Ave, Detroit. $185,000.

Mich., River Rouge—Ford Motor Co, 3674 Schaefer Rd, Dearborn, awarded contract constructing foundry, concrete fdn, to Bryant & Detwiler Co, 2304 Penobscot Bldg, Detroit. Est $1,704,000.

Mo., St. Louis—Scullin Steel Co, 6700 Manchester Ave, awarded contract constructing plant alterations, addns, to Fruin-Colnon Contg Co, 502 Merchants Laclede Bldg. Est $1,200,000. Defense Plant Corp will finance.

Mont., Fort Peck—U. S. Eng, 1201 Davidson Bldg, Kansas City, Mo., awarded contract constructing power house superstructure, surge tank bldg, installing penstock and butterfly valves for Fort Peck Project, to Fegles Constr Co, 711 Wesley Temple Bldg, Minneapolis, Minn. $3,407,026. Est $3,011,766.

Neb., North Platte—S W Throckmorton, city clerk, awarded contract constructing municipal light and water bldg, to Haddorff Bros Constr Co, North Platte. $42,000.

N. J., Elizabeth—Pub Serv Electric & Gas Co, 80 Park Pl, Newark, awarded contract constructing brick steel Bayway switching station, equip, outdoor structure, etc, to United Engineers & Constructors, Inc, 1401 Arch St, Phila, Pa. $1,300,000.

N. M., Roswell—U. S. Eng, Caddoa, Colo., awarded contract constructing sewage disposal plant, incinerator, 500,000-gal water tank and tower, to Kilbourne L House, 1300 E Marquette Pl, Albuquerque. $81,051.

N. Y., Brooklyn—Equitable Life Assurance Society of the United States, 393 7 Ave, New York, awarded contract constructing Clinton Hall Housing, six 12 to 14 story bldgs, Myrtle and Willoughby Aves, Vanderbilt and Waverly Aves and five 12 to 14 story bldgs, between Clinton and Waverly Aves, to Starrett Bros & Eken, Inc, 63 Wall St, New York. Est $7,000,000. Harrison, Fouilhoux & Abramovitz, 45 Rockefeller Plaza, New York, archts G D Clarke, 10 Rockefeller Plaza, New York, landscape archt E E Ashley, 10 E 40 St, New York, mechanical engr

FOR EFFICIENT *all-Out* PRODUCTION

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An outstanding GARLOCK Packing for *long, dependable* service is GARLOCK CHEVRON, illustrated below. Like other GARLOCK Packings, CHEVRON permits you to avoid frequent shut-downs for re-packing . . . helps you maintain your share of the all-out, full-capacity production needed for Victory.

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GARLOCK 530 CHEVRON for steam, air or gas.
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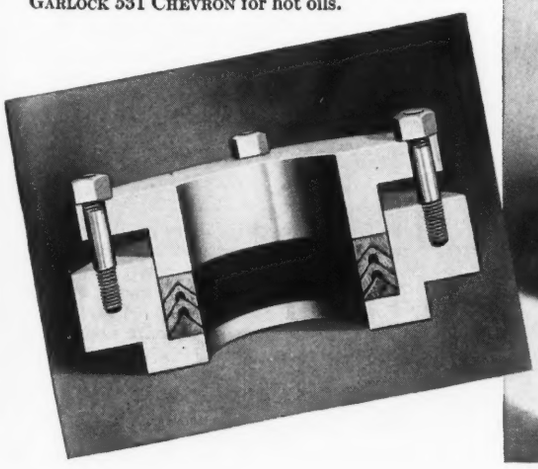
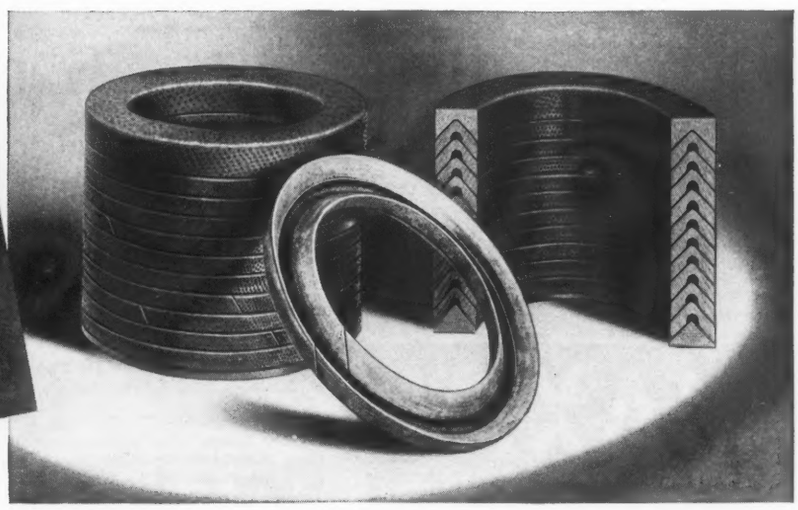




SURE IT'S WAR..

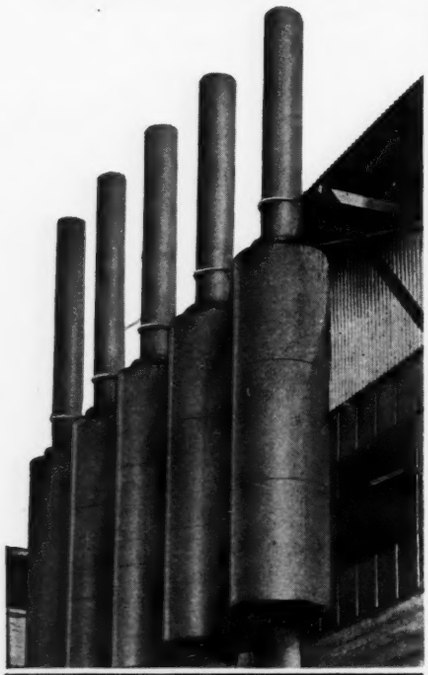
BUT NOT AGAINST YOUR NEIGHBORS!

In today's rush of all out production with day and night shifts, it is all too easy to overlook such things as the effect your "night shift" operation may have on some of your neighbors.

You can save them the annoyance of the penetrating thump of engine exhaust or intake, compressor intake or the roar of steam blow-off by installing Maxim Silencers. Write for details.

The Maxim Silencer Co.

92 Homestead Ave., Hartford, Conn.



MAXIM SILENCERS

J Distasio & Co, 136 Liberty St, New York, structural consult engrs.

N. Y., Jamestown—Bd P Utilities, City Hall, T V McKee, secy, awarded contract constructing 3000-kva substation, Harrison St, to General Electric Co, 1 River Rd, Schenectady. $42,304. Est. $40,000.

N. Y., Lewiston—War Dept, 20 St and Constitution Ave, N W Wash., D. C., awarded contract constructing plant (product unknown), near here, to J G White Eng Corp, 80 Broad St, New York, N. Y. Est $20,000,000.

Ohio, Cleveland—Republic Steel Corp, Republic Bldg, awarded contract constructing power plant, to United Engineers & Constructors, Inc, 1401 Arch St, Phila., Pa. Est $8,000,000. Defense Plant Corp will finance.

Ohio, Lorain—National Tube Co, Lorain, awarded contract rebuilding No 4 blast furnace, to Arthur G McKee & Co, 2422 Euclid St, Cleveland. $1,500,000.

Ohio, Warren—Republic Steel Corp, Republic Bldg, Cleveland, O, awarded contract for coke ovens, to Semet-Solvay Co, 40 Rector St, New York, N. Y. Est $2,000,000. Defense Plant Corp will finance.

Ohio, Youngstown—Republic Steel Corp, Republic Bldg, Cleveland, awarded contract constructing blast furnace, to Standard Boiler & Plate Iron Co, Niles. Est $6,500,000. Defense Plant Corp will finance.

Pa., Braddock—Carnegie-Illinois Steel Corp, M W Reed, ch engr, 434 5 Ave, Pittsburgh, awarded contract constructing two industrial bldgs, to Arthur G McKee & Co, 2300-Chester Ave, Cleveland, O. Est $6,000,000. Defense Plant Corp will finance.

Pa., Coatesville — Lukens Steel Co, Coatesville, will construct additional facilities, plant for Navy Dept, own forces. $17,000,000.

Texas, Camp Barkeley—U. S. Eng, Camp Barkeley, awarded contract constructing additional heating plant unit, facilities, boiler house, service distr line, etc, to M Murphy Boiler & Heating Co, Shawnee, Okla. $50,974.

Texas, Houston—U. S. Eng, Federal Bldg, Galveston, awarded contract constructing Barker Dam, near Addicks, 14 mi from here, for Harris County Flood Control & Imprvt Dist, to Macco Constr Co, 818 Paramount Blvd, Clearwater, Calif. $1,767,872. Est $2,000,000.

Texas, Texas City—Monsanto Chemical Co, 1700 S 2 St, St. Louis, Mo., will convert sugar refinery to Chemical Mfg plant for synthetic rubber, force account. $800,000 or more.

Texas, Texas City—Tin Smelting Corp, Texas City, awarded contract for design and construction, new plant unit to Ford, Bacon & Davis, Inc, 39 Bway, New York, N. Y. Est $2,000,000. Reconstruction Finance Corp will finance, N V Billiton-Maastchapij, c/o J Van Der Broek, 10 Rockefeller Plaza, New York, will operate.

Texas, Wichita Falls—Perkins Timberlake Dept Store, 9 and Indiana Sts, will construct electric power plant. Owner builds. $40,000. J E Ward, Harvey-Snider Bldg, Wichita Falls, engr.

Wash., Tacoma—City, awarded contract for 55,000 hp hydraulic turbine, La Grande power house and two 34,500 hp turbines, Alder power house, to Pelton Water Wheel Co, 2929 19 St, San Francisco, Calif. $1,228,700.

West Virginia—U. S. Eng, Chesapeake & Ohio Bldg, Huntington, awarded contract constructing Bluestone Dam, New River, near Hinton, to Dravo Corp, Neville Island, Pittsburgh, Pa. $11,376,080.

ROCKWELL Blast Gates are better designed, combine light weight with strength and are carefully machined and tested. They close airtight and have graduated dials for accurate setting and resetting.

Made in all types—slide, kwikleen, butterfly and wafer, with lever, handwheel and chain wheel control—there's a Rockwell Blast Gate for every requirement. Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

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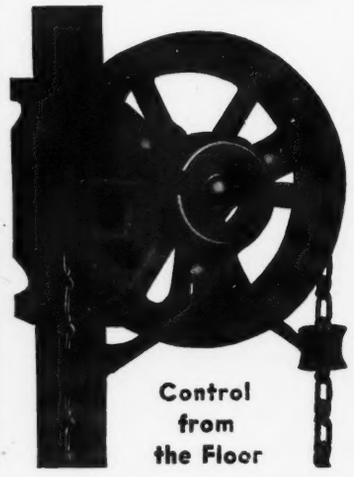
Make Your Overhead Valves SAFE And Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the stepladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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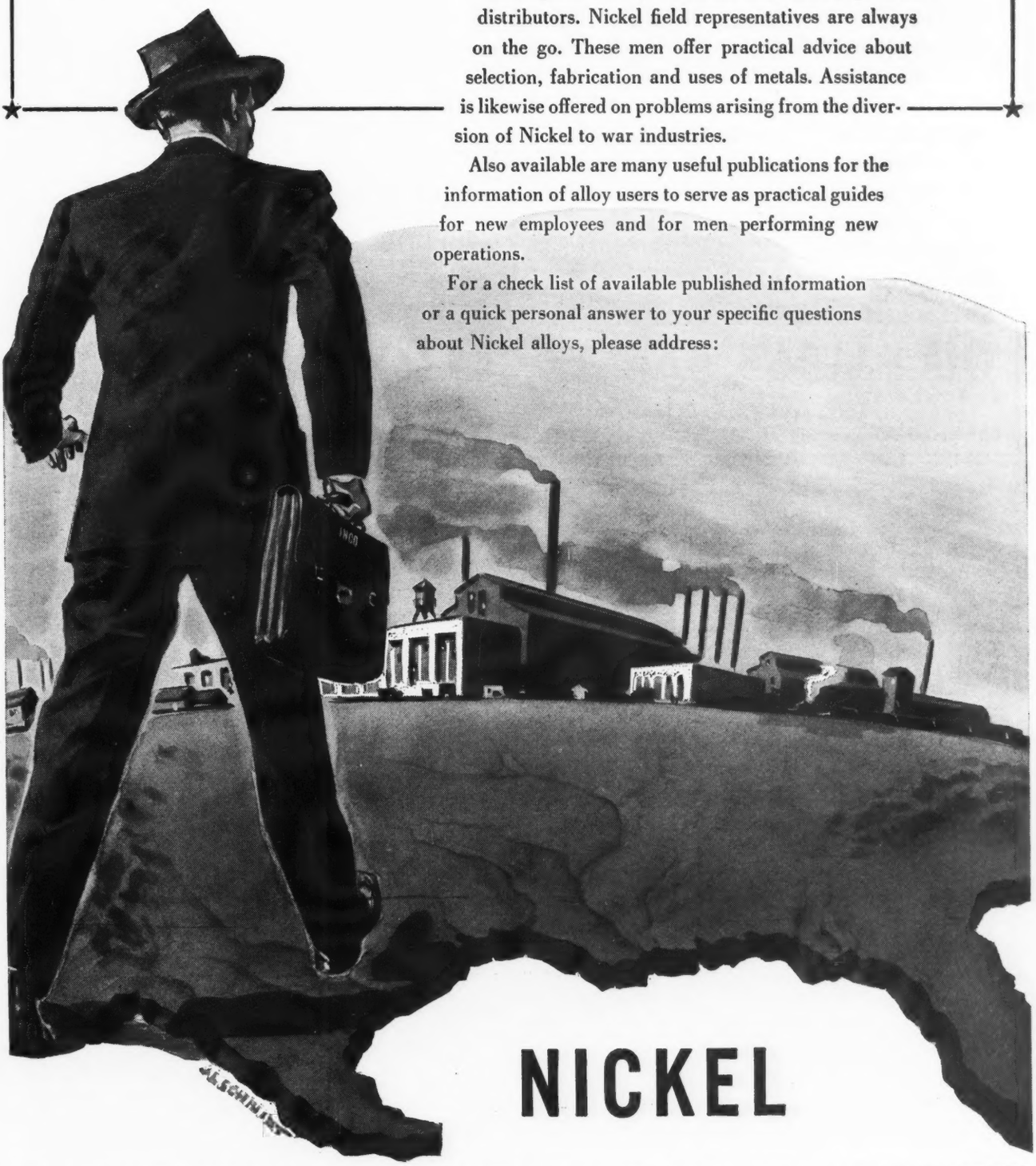
New Bedford, Mass.

ON THE MARCH to aid users of alloys...

FIELD offices are maintained by International Nickel's Development and Research Division and by qualified distributors. Nickel field representatives are always on the go. These men offer practical advice about selection, fabrication and uses of metals. Assistance is likewise offered on problems arising from the diversion of Nickel to war industries.

Also available are many useful publications for the information of alloy users to serve as practical guides for new employees and for men performing new operations.

For a check list of available published information or a quick personal answer to your specific questions about Nickel alloys, please address:



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PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

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Cuts your gasket costs in half

The most remarkable tool ever invented

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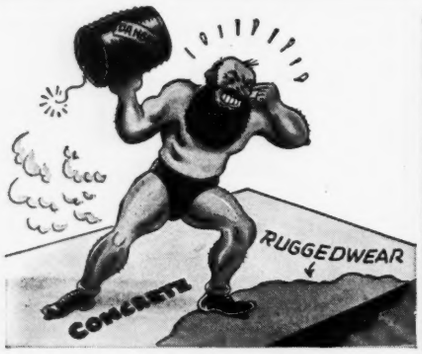
Distributors everywhere *Mamaroneck, N. Y.*



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. . . this Floor Patch Can Really Take It!

Full speed War production demands smooth, wear-proof floors. Use tough, he-man RUGGGEDWEAR Resurfacer for patching or resurfacing an entire area. No chopping or chipping required. Merely sweep out the spot to be patched—mix the material—trowel it on. Holds solid and tight right up to irregular edge of old concrete. Cellulose-Processed to provide a firmer, tougher, smoother, more rugged wearing surface. Used indoors or out. Dries fast. Low in Cost.

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Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER—no obligation.

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"STANDCO" PILLOW BLOCKS

Fig. 1635

Combining clamp block and pillow block requirements in one type, the "Standco" shown above is sturdily built and is offered in a wide range of sizes. Babbitted bearing surfaces are finished beautifully smooth, both faces machined. It can be depended on for long, trouble-free service.

"Standco" Ball and Socket Pillow Block, Ring or Wick Oiling, Plain or Collar End Babbitted Bearings.

Fig. 32

Write for Bulletin

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA.

Boston Detroit Indianapolis Box 577 Chicago St. Louis San Francisco

Engineers' Books

(*Continued from page* 122)

study of expansion stresses and reactions in high-temperature piping systems, including a bibliography of published material, derivation of formulae and design data. Methods given apply principally to single-plane systems. Strictly for the pipe designer.

Plastics

PLASTICS CATALOG (1942). *Published by Plastics Catalogue Corp, 122 East 42 St, New York, N. Y. 624 pages, 9 x 12 in. Price $5.*

A record of progress in the expanded uses and techniques of plastic design. The part plastics are playing in the production of war materials is described, and the various materials and applications detailed. Chapters cover plastics engineering, production methods, machinery and equipment, laminates, fibre, coatings, synthetic fibers and rubbers and a directory of manufacturers.

Power Stations

ELECTRIC POWER STATIONS (1941). *By T H Carr. Published by D Van-Nostrand Inc, 250 Fourth Ave, New York, N. Y. 376 pages, 5½ x 8½ in., illustrated, cloth cover. Price $7.50.*

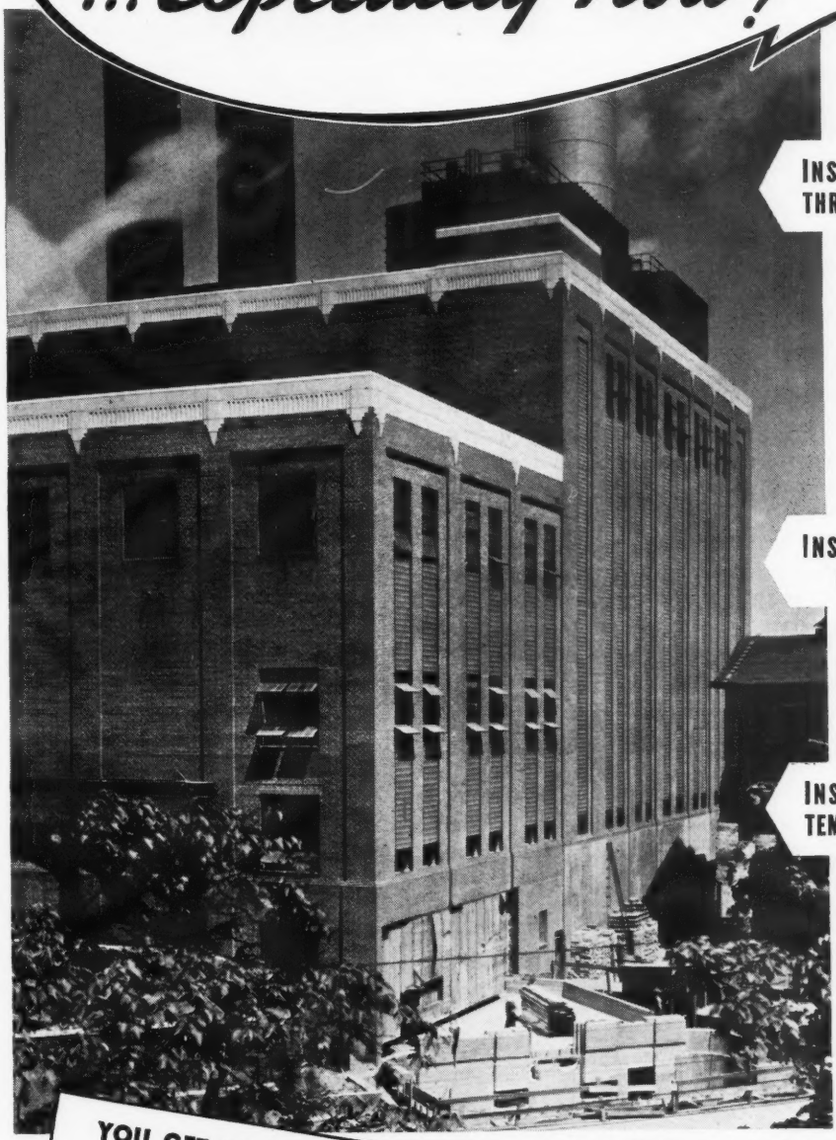
A review of British practice in central-station design of interest to many in this country for comparison with American practice. The book deals broadly with design, layout, construction and operation of steam power plants. Starting with selection of site and construction of foundations, the description proceeds to cover buildings, railway facilities, outdoor stations, coal, ash and water systems, boiler plant, pipework and turbines.

Arc Welding

PRACTICAL ARC WELDING (1942). *By W J Chaffee. Published by Hobart Trade School, Inc, Troy, Ohio. 516 pages, 5½ x 8 in., flexible binding, illustrated. Price $2.*

Straight from the shoulder, profusely illustrated, this book starts by telling where and how arc welding is employed in modern design and construction. Design of welds, equipment and personnel for welding operations, training courses, how to start and manipulate the arc, how to weld light, gage sheets.

Sure, . . . INSULUX Glass Block are best for Power Plants *. . . Especially Now!*



Indianapolis Power & Light Co.
Indianapolis, Ind.

INSULUX PANELS TRANSMIT DAYLIGHT THROUGH A 4-INCH PROTECTING WALL!

Today, the Power House can get more usable natural daylight, evenly distributed to deep interiors, when INSULUX Glass Block panels are used. INSULUX offers the added protection of sturdy masonry construction plus full privacy assured by the translucent, but non-transparent, nature of the block design. INSULUX panels are extra defense for the Power House, nerve center of Industry!

INSULUX ADMITS DAYLIGHT ONLY...
(Dust, dirt, moisture stay out!)

Power breakdowns are more serious today than ever before. Dust and dirt can damage equipment. Insure clean air near light-transmitting areas by installing tightly sealed panels of INSULUX Glass Block.

INSULUX PANELS AID IN TEMPERATURE CONTROL...

INSULUX is approximately twice as efficient as windows in maintaining even temperature. You can use larger light-transmitting areas without excessive heat transfer. INSULUX Block are two thicknesses of heavy glass, with dead air space between.

LOWER UPKEEP MAKES SENSE TODAY, TOO!

Tall, inaccessible light-transmitting areas are ordinarily hard to maintain and keep clean. A damp cloth cleans INSULUX, and there's nothing to rot or corrode, requiring repair, painting or replacement.

YOU GET PROMPT DELIVERY ON INSULUX!
USE INSULUX GLASS BLOCK AND SAVE PRIORITY MATERIALS!

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INSULUX
Glass Block

OWENS-ILLINOIS GLASS COMPANY, INSULUX Products Division
Dept. 23, Ohio Building, Toledo, Ohio

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TIME SAVED ON POWER PLANT MAINTENANCE JOBS *Helps National Defense*

For Example:

CLEANING HEAT EXCHANGERS

Power plant equipment today must operate at peak efficiency! That is particularly true of such units as feedwater and fuel oil heaters, Diesel engines, surface condensers, "lube" oil and jacket-water coolers.

One frequent source of trouble is the accumulation of lime-scale, carbonized oil and sludge deposits that impair heat transfer efficiency. But you can remove them EASILY, without dismantling equipment, by cleaning heat exchangers the fast, low-cost Oakite way. Circulating recommended Oakite solution as directed thoroughly removes deposits. Normal heat transfer is restored . . . units are back in service quickly!

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FREE on request, a NEW 24-page manual gives time-saving tips for doing this and other essential maintenance jobs the easier, safer Oakite way. Write for YOUR copy today!

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OAKITE *Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

cast iron and copper are among the many practical subjects covered briefly but clearly. Each design or method is charted and illustrated. A book every welder should own and one that should be handed to every young man who would become a welder.

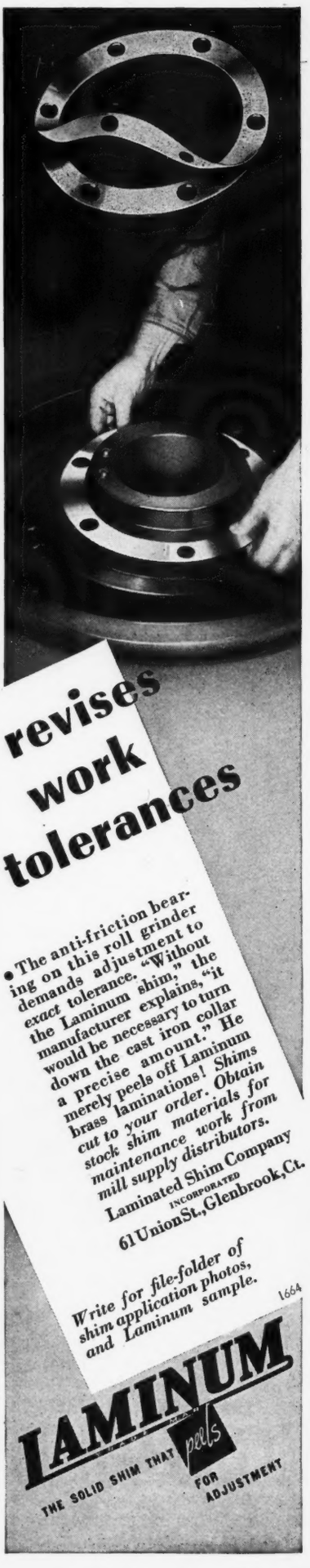
BELT CONVEYORS AND BELT ELEVATORS (Third Edition—1941) *By Frederic V Hertzel and Russell K Albright. Published by John Wiley & Sons, Inc, 440 4th Ave, New York, N. Y. 439 pages, 6x9 in., illustrated, tables, Cloth binding. Price $6.00.*

Belt conveyors and belt elevators form two very large classes of material-handling equipment which are extensively treated in this book, which aims to explain principles and the reasons for practices in design and operation. The treatment is divided in two sections, belt conveyors and belt elevators so that there is the equivalent of two distinct books bound under the one cover. Under belt conveyors the subject is treated under the headings: general description of component parts, development of belt conveyors, belts and belt manufacturers, supporting and guiding the belt, driving the belt, design of belt conveyors, tension and takeup devices, loading the belt, discharging from the belt, protecting and cleaning the belt, weighting and separating, package conveyors, particular use of belt conveyors, life of belts, when to use belt conveyors. Belt elevators are treated under the titles: general description, centrifugal-discharge elevators, elevator buckets, continuous bucket elevators, belts for elevators, fastening buckets to belt, driving belt elevators, elevator boots, and inclined elevator. An appendix gives tables of weights of materials handled by belt conveyors and belt elevators. To say that the different subjects have been treated comprehensively and practically in an easily read style is all that is needed to recommend this book to anyone interested in belt conveyors and elevators.

Brief Reviews

THERMODYNAMICS OF BOILER FEEDING: *By Igor J Karassik, Worthington Pump & Machinery Corp. Published by Hydraulic Institute 90 West St, New York, N. Y. Price 50¢.*

Prize winning essay of the first annual contest of the Institute. Discusses feedwater pumping power and mechanical problems, analysis of temperature rise in boiler-feed pumps, thermodynamic efficiency of pumping, disposal of by-


revises work tolerances
• The anti-friction bearing on this roll grinder demands adjustment to exact tolerance. "Without the Laminum shim," the manufacturer explains, "it would be necessary to turn down the cast iron collar a precise amount." He merely peels off Laminum brass laminations! Shims cut to your order. Obtain stock shim materials for maintenance work from mill supply distributors.
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THE SOLID SHIM THAT peels FOR ADJUSTMENT

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—make it possible to keep an accurate record of the coal being fed to each boiler—prevent the segregation of coal—and permit an entire row of boilers to be supplied from a single bunker located at the end or entirely outside the building, resulting in substantial savings in building and bunker costs. Hand propelled and motor driven types in capacities from ½ ton to 20 tons per single trip. Eng. Bul. No. 83 sent on request, gives full details. The C. O. Bartlett & Snow Co., 6205 Harvard Avenue, Cleveland, Ohio.

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MODERN FIRING FOR EXISTING BOILERS

FREEMAN MFG. CO.
RACINE WIS.
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RACINE WIS.
Formerly, both of these boilers had to be fired to carry maximum load. With the new FYR-FEEDERS, either one can handle the job alone.

FYR-FEEDER

RISING TIDE OF ACCEPTANCE: FYR-FEEDER "Multi-feed" Spreader Stoker sales in 1941 showed an increase of 67% over 1940—due in large part to FYR-FEEDER'S ability to increase the capacity of many existing boilers.

64% FOR MODERNIZATION! 18% of 1941 FYR-FEEDER sales replaced underfeed stoker firing; 18% replaced overfeed stoker firing; 28% replaced oil burning furnaces, hand-fired grates, or pulverized coal. These installations consistently resulted in lower fuel costs . . . increased capacity . . . lower maintenance costs.

MANY REPEAT ORDERS! Nearly 37% of all FYR-FEEDER sales in 1941 were repeat orders—best proof of users' satisfaction.

DELIVERY. Quick delivery of FYR-FEEDER Spreader Stokers is assured for industrial plants working on Defense contracts . . . plants producing essential civilian goods . . . food processing plants . . . institutions and schools . . . mines . . . utility plants . . . railroad steam plants . . . or plants otherwise qualified to obtain priority ratings. For complete details, use the coupon below.

TERRITORIES FOR SALES ENGINEERS
Some territories are open for experienced sales engineers familiar with steam plant boilers and furnaces. Information on request. Please furnish record of your experience and references.

AMERICAN COAL BURNER COMPANY

F O U N D E D 1 9 1 8

Builders of thousands of over-feed stokers

AMERICAN COAL BURNER COMPANY, ENGINEERS
23-18 East Erie St., Chicago, Ill.

☐ YES. I want to know what the FYR-FEEDER can do in our plant.
☐ Please mail descriptive literature.
☐ I am interested in selling FYR-FEEDERS.

Name .....
Company .....
Address .....

You Can See the Superiority
AIR FROM NOZZLES
① SPREADS COAL
② PROVIDES AIR FOR COMBUSTION
③ CREATES TURBULENCE IN COMBUSTION CHAMBER
MULTIPLE SCREW FEEDERS 12" APART
TWO FIRES: FINES BURN IN SUSPENSION, LARGER COAL ON GRATE
COAL
AIR IN TO INDIVIDUAL BURNERS
UNDER GRATE AIR

Each FYR-FFEDER has 2, or 4, or more burner spreaders giving dependability and convenience in cleaning grates impossible to secure with a single spreader. MULTIPLE BURNER SPREADERS ARE A VERY WORTHWHILE ADVANTAGE.

pass and leakoffs. Parts of this paper have appeared in POWER (March, May, 1941) and SOUTHERN POWER AND INDUSTRY (November, 1941).

METALLURGY AND PIPING. *Prime Movers Committee report of the Edison Electric Institute, 420 Lexington Ave, New York, N. Y. Price 70¢ to members, $1.75 to non-members.*

Contains statements by operating companies and manufacturers on creep, piping for high-temperature service, reducing valves and high-temperature bolting.

Power Lines

(*Continued from page* 122)

may affect the ability of the mining and transportation industries to supply it. Among the factors which may impair the coal supply are shortages of rubber, steel, machinery and other necessary supplies; the effect of the draft and other factors on the labor supply; the tightening of transportation and the dangers of snarls which may hamper the movement of coal from time to time.

"The Office of Solid Fuels Coordination feels that wise consumers will store reserve coal while they can get it; and they then will keep their bins full. Consumers whose storage facilities may not be large enough to give them adequate protection would do well to use appropriate means to increase those facilities.

"When the continuous flow of the usual coal supply is interrupted by an emergency it may not always be possible to find an emergency source of fuel and get the coal to the plant unless such a consumer is protected by adequate reserves before he has to quit operations."

OBITUARIES

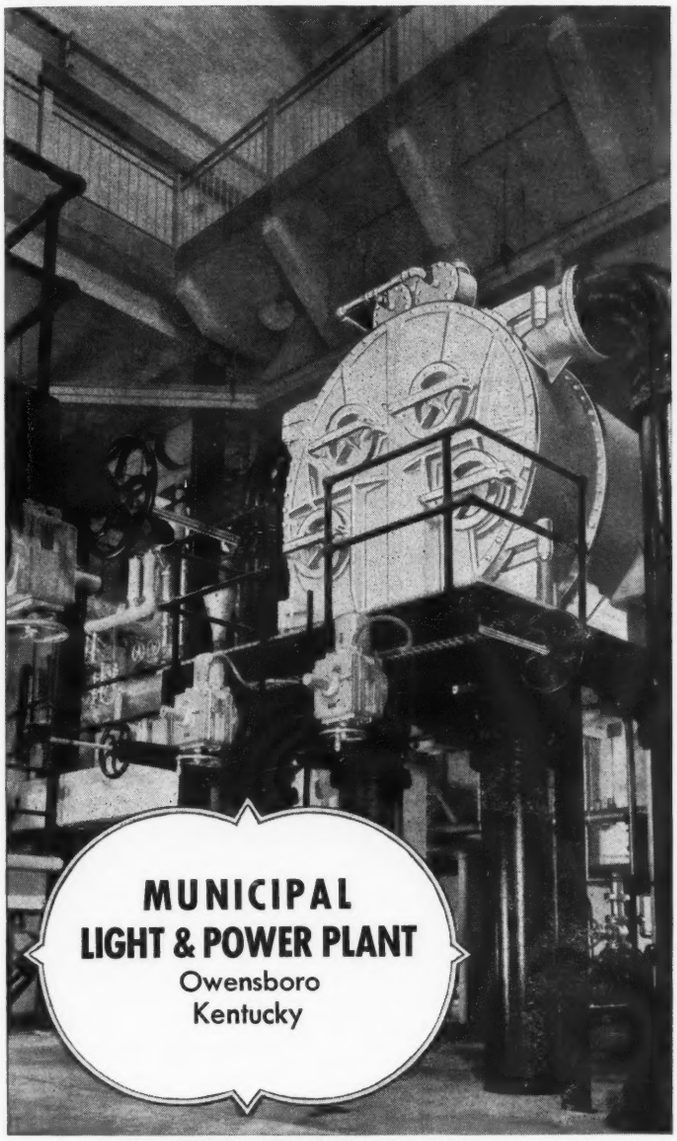
LIEUT COM WALTER DOUGLAS LAMONT, 52, an engineer and inventor, died Jan 19. Commander LaMont, who was president of W D LaMont, Inc, New York, and Steam Power, Inc, also New York, developed the LaMont boiler 20 years ago. He was the inventor of the LaMont duplex sealed valve, designed to prevent boiler explosions, and had recently developed a "booster", a small unit attached to old boilers to increase their power output. (This was described on page 80 of the March 1941, issue of POWER). On his retirement from the United States Navy in

Careful Attention to Details

NEEDED FOR THIS SURFACE CONDENSER INSTALLATION

. . . . SO THE JOB JUST NATURALLY WENT TO

ROSS

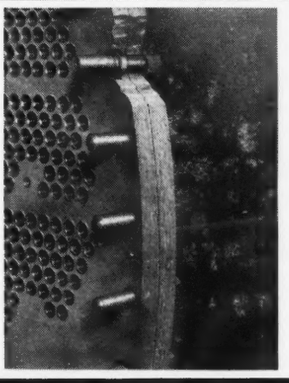


An appearance as neat as its performance. This was a prerequisite for the 10,000 sq. ft. All-Welded Steel Surface Condenser most recently added to Owensboro's model plant.

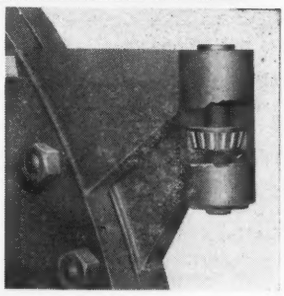
So, engineers and designers of this showplace selected Ross, builders of America's first All-Welded Steel Condenser.

Smooth, compact and trim, the shell arrangement of this job is typical of Ross workmanship. No wonder, then, that it is recognized as the ideal Surface Condenser.

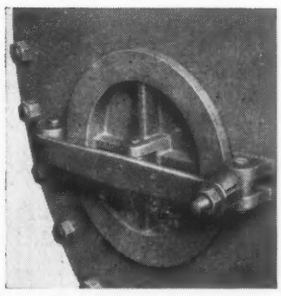
The few features, emphasized herewith, only begin to illustrate numerous instances where quality and careful attention to details are found in Ross Condensers.



Collar bolts hold tube sheets firmly to shell.



Timken roller bearings for perfect alignment, easy operation.



Quick opening inspection ports.

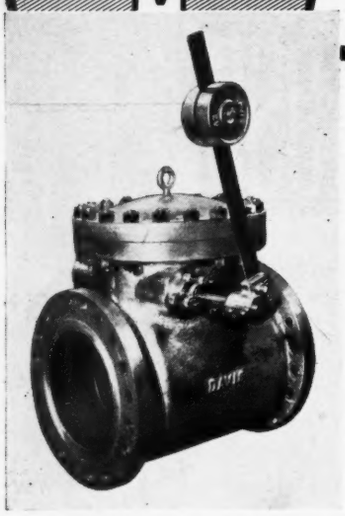
Complete information on this, and other interesting power plant installations, will be gladly discussed by any Ross representative.

ROSS HEATER & MFG. COMPANY, Inc.

Division of AMERICAN Radiator and "Standard" Sanitary Corporation

GENERAL OFFICES AND PLANT -- BUFFALO, N. Y.

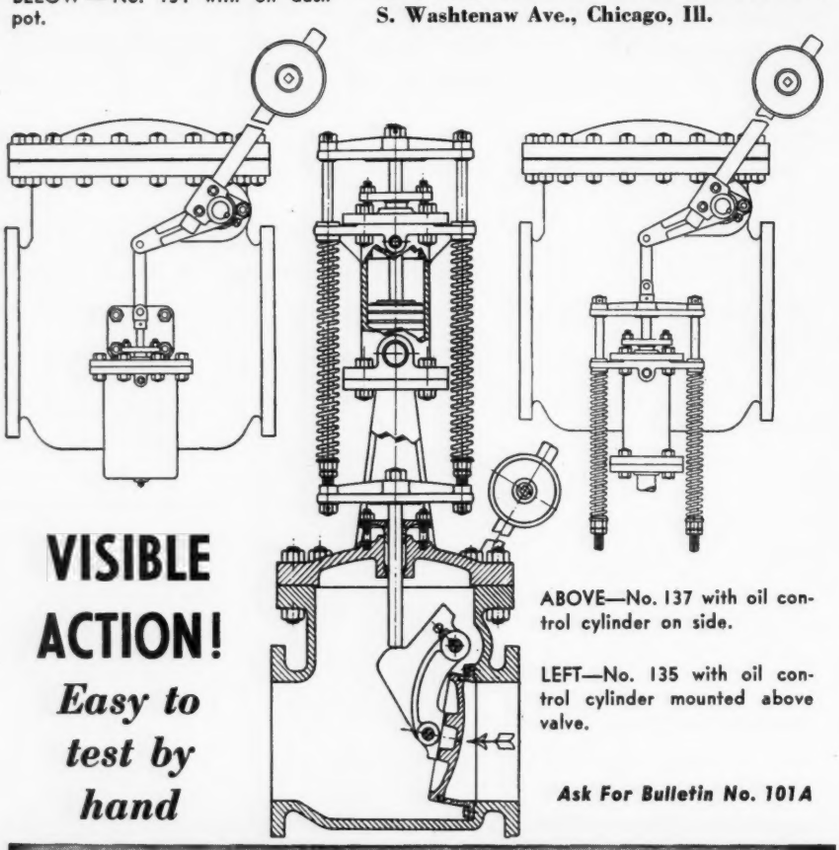
TURBINE NON-RETURN VALVES



1—Davis No. 134 counterbalanced swing check type non-return valve. BELOW — No. 134 with oil dash pot.

THE Davis line of Turbine Non-Return Valves includes a wide choice of tested designs developed through many years of experience in working with the nation's foremost power plant designers and engineers. These designs include both poppet type valves and the counterbalanced swing check type of valve shown here. Auxiliary features include spring loaded oil cylinders and trip levers to insure quick, positive closing in case of emergency.

All Davis Turbine Non-Return Valves are designed to provide maximum safety, sensitive action, and unrestricted flow. Standard sizes from 4" to 24". For any pressure. For information, recommendations, and literature, write DAVIS REGULATOR CO. 2540 S. Washtenaw Ave., Chicago, Ill.



VISIBLE ACTION!

Easy to test by hand

ABOVE—No. 137 with oil control cylinder on side.

LEFT—No. 135 with oil control cylinder mounted above valve.

Ask For Bulletin No. 101A

DAVIS REGULATOR COMPANY

1924, he organized the LaMont Corp, with offices at 200 Fifth Ave, New York, to manufacture his boiler. He left the corporation a few years later and organized the new corporation which he headed at the time of his death.

PHILIP TORCHIO, retired vice-president of Consolidated Edison Co, New York, died Jan 14, 1942. Mr Torchio was educated by private tutors at the Gymnasium and Lyceum at Como, Italy, and was graduated from the University of Pavia, the Royal Polytechnic, Milan, and the Institute Carlo Erba. Coming to New York after graduation, he became a draftsman and later chief draftsman of the Sprague Elevator Co. In 1895 he became a draftsman for the Edison Electric Illuminating Co of New York, one of the predecessors of Consolidated Edison Co. In 1924 he became vice president in charge of electrical engineering of the New York Edison Co. He also acted as consulting engineer for other electric companies in what is now the Consolidated Edison System, and became a director of three of them. He retired from the Consolidated Edison in Aug 1938. Mr Torchio had been president of the New York Electrical Society, Fellow of the American Institute of Electrical Engineers, member of the Franklin Institute, the Illuminating Engineering Society, and other business and trade organizations.

LIEUT-COL GEORGE D BABCOCK, director of engineering management of the Federal Works Agency, and former management engineer of the REA, died in Washington Jan 12. Prior to becoming chief ordnance supply officer in the first World War, he was production manager of the Franklin Mfg Co. From 1934 to 1937 he was with various federal works and relief agencies before taking the REA post.

CAMERON DOUGLAS FLANIGAN, 87, former president of the Athens Electric Railway Co, Athens, Ga., died Jan 9. He became a vice president of the Georgia Power Co in 1927, and last year was elected to the board of directors. He was a native of Philadelphia, but came to Athens in 1879.

S F SMITH, 77, late president of the S Morgan Smith Co, York, Pa., passed away Jan 19, 1942. Born in York County, Pa., in 1864, Mr Smith entered his father's business upon completing his education in 1883, and from 1896, when the business was incorporated as the S Morgan Smith Co, he served as senior vice president and director until 1937, when he assumed the office of

New York City's new $19,000,000, 17 story

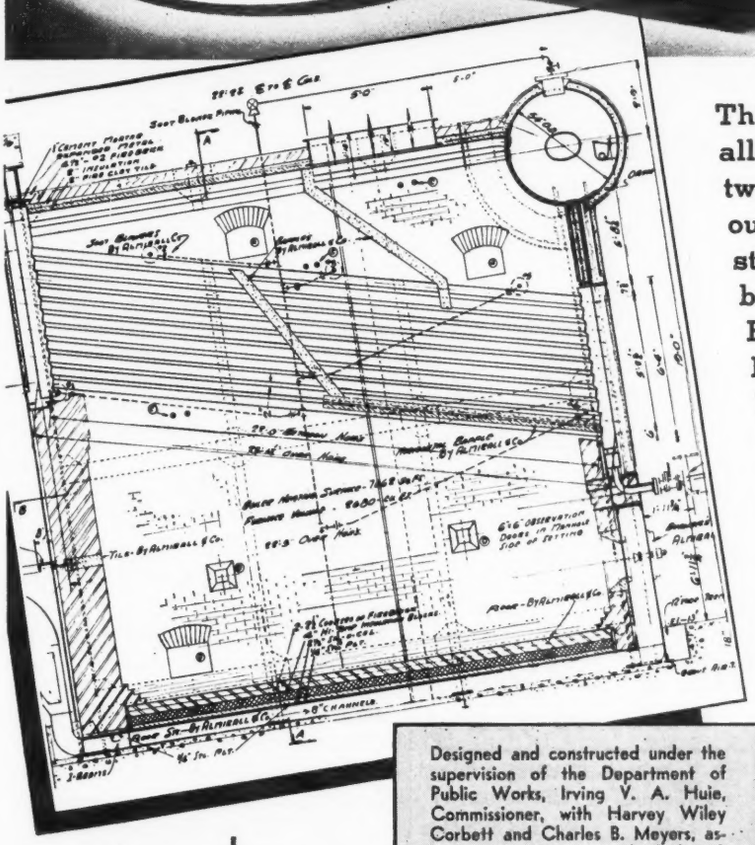
CRIMINAL COURTS BLDG. AND CITY PRISON

Served by

4 VOGT

Forged Steel

SECTIONAL HEADER BOILERS

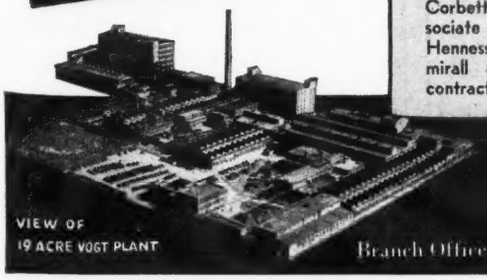


Thirty Court Rooms and Jury Rooms, all completely air conditioned, and a twelve story Prison are housed in this outstanding Public Building. All the steam requirements will be supplied by four Vogt Sectional Header Boilers.

Each steam generating unit has 7,062 sq. ft. of heating surface designed to generate 47,000 pounds of steam per hour at 200% rating, using oil for fuel. Headers, forged from seamless steel tubing, and the fusion welded steam drum are designed for 200 pounds working pressure.

Designed and constructed under the supervision of the Department of Public Works, Irving V. A. Huie, Commissioner, with Harvey Wiley Corbett and Charles B. Meyers, associate architects, and Syska & Hennessy, consulting engineers. Almirall & Company, Inc., heating contractors.

Vogt builds steam generating equipment in many types and sizes to meet every heating, power, or processing requirement.



VIEW OF 19 ACRE VOGT PLANT

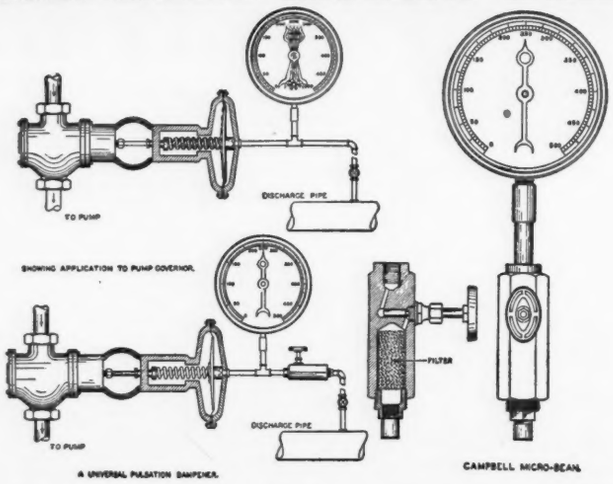
HENRY VOGT MACHINE CO., Inc.
LOUISVILLE, KY.

Branch Offices: New York - Philadelphia - Cleveland - Chicago - Cincinnati - St. Louis - Dallas

New way to dampen pulsations

Nothing else like it on the market!

CAMPBELL MICRO-BEAN



When installed in the pressure line to diaphragm of pump, governor will pay for itself two or three times a year. Eliminates jittering of gauge needles. Smoothes out performance of entire boiler plant. Built for a lifetime of service. You ought to know more about this amazing device. Write for Bulletin.

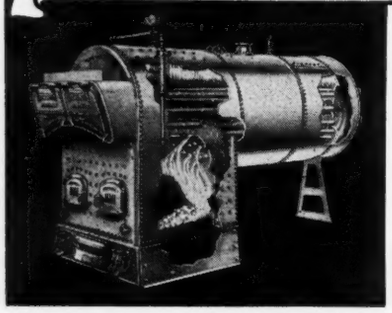
Also manufacturers of Cantilever Feed Water Level Controllers

J. A. CAMPBELL CO.

649 E. Wardlow Road, Long Beach, California

KEWANEE FIRE BOX BOILERS

Extra Strength . . . for Heavy Duty



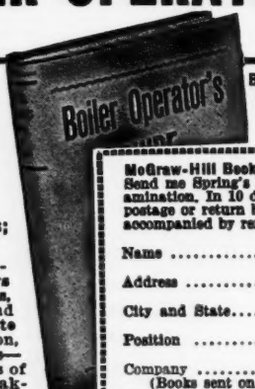
100, 125 and 150 lbs. W.P. . . . sizes for 4 to 300 Horse Power. Their known strength, steel plus rivets supplemented by extra stout stays and braces in the boiler shell, adds extra years of service.

For 6" rule with scale for reading pipe sizes, write Dept. 96 K-III.

KEWANEE BOILER CORPORATION Kewanee, Illinois

THIS NEW **BOILER OPERATOR'S GUIDE**

. . . can mean money to you!



JUST OUT! Here's information of the most priceless sort for you — whether you want to improve your ability as an inspector or to utilize effective inspection methods in the more efficient, safer operation and upkeep of your own boilers.

Helps you meet everyday problems; Prepares you for license exams

With hundreds of typical examination questions and answers as well as complete instructions, this book presents fully and plainly the things you want to know about proper installation, operation, and care of boilers—the things that prevent dollars of loss in reduced efficiency, breakdown, or even accident.

By H. M. Spring, Jr.
353 pages, 6 x 9
241 illustrations
$3.00

EXAMINE A COPY FOR 10 DAYS ON APPROVAL

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.
Send me Spring's Boiler Operator's Guide for 10 days' examination. In 10 days I will send you $3.00, plus few cents postage or return book postpaid. (We pay postage on orders accompanied by remittance.)

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president. He held this office until the time of his death. He was associated with his brother in the development of several large hydroelectric projects in the Southern states.

HENRY A MENSING, 85, retired stationary engineer, died Jan 25 at his home in Rochester, N. Y.

THOMAS J CONNOR, 48, vice president in charge of production, and a member of the board of directors of Caterpillar Tractor Co, Peoria, Ill., died suddenly Friday, Jan 23. Mr Connor left high school to become an apprentice at the Geiger Iron Works at Stockton, Calif., and after four years became full-fledged machinist. Mr Connor took a machinist's job with the C L Best Tractor Co four years later, becoming production line foreman and tool foreman later. When the Holt and Best Companies were merged in 1925 to form Caterpillar Tractor Co, Mr Connor was placed in charge of the design and production of tools. He was named general factory manager of Caterpillar in 1930 and was advanced to the position of vice president in charge of manufacturing and appointed a director of the company in 1934. At the time of his death Mr Connor was vice president in charge of production, administrative head of engineer, purchasing, industrial relations and training, and public relations departments, and a director.

GEORGE B MATHEWS, 95, for many years a leading figure in Niagara power circles, died suddenly Feb 3 at his Buffalo, N. Y., home. He was prominent in the development of hydroelectric power facilities at Niagara Falls.

BENJAMIN F RUSH, who retired in 1935 after 53 years' service with the Brooklyn Edison Co., died Sunday, Jan 18, at his home in Brooklyn. Mr Rush joined Poe, Sewall & Co in 1882, which was then preparing to build Brooklyn's first electric light plant. Its franchise was acquired in 1884 by the Citizens Electric Illuminating Co, which began operations later that year. The Citizens Co was consolidated in 1895 with the Edison Electric Illuminating Co of Brooklyn, which later became the Brooklyn Edison Co. Mr Rush worked in various bureaus of the operating departments until 1907, when he was appointed to represent the company at the Board of Fire Underwriters and in city departments in securing permits. He held that position when he retired.

EZRA FRICK, president of Frick Co, last of the great pioneers in the re-

"With GULF DIESEL OILS we get a 3-way saving in the operation of this unit" . . . says this Chief Engineer

"WHEN we installed this Diesel engine three years ago, we knew just what lubricating oils would be best for it," says this chief engineer of the municipal power plant, city of Opelousas, Louisiana. "Gulf Diesel Oils had helped us get efficient trouble-free operation for many years from our older Diesels. So, right from the start, we've used the same quality oils to lubricate this unit. And we're getting the same efficient operation—no repairs, no stuck rings, and maximum kw.-hr. performance."

How can you be sure you are using the Diesel oils which best possess the qualities to stand up under today's conditions of high loads and continuous operation? Here's your safest course: Ask a Gulf engineer to look over your Diesels and recommend the proper Gulf Diesel lubricating oil for each moving part. Then follow his recommendations. Thus you will get the benefits of the improved characteristics which exhaustive research and advanced refining methods have imparted to Gulf's higher quality lubricants.

Gulf quality Diesel Oils are quickly available to you from more than 1200 warehouses in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

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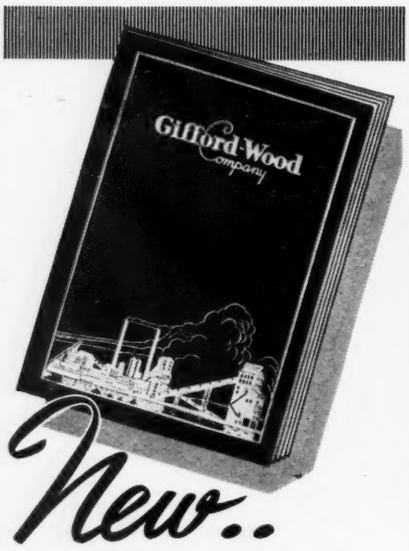
GULF INDUSTRIAL LUBRICATION



New..

IDEA STIMULATOR AND SOURCE BOOK

Use this new 124-page, substantially bound book as a source of ideas on how to expedite the handling of any bulk and package materials. It illustrates, describes and gives essential engineering information on elevating and conveying machinery for all industries, designed and manufactured by Gifford-Wood to meet purchasers' requirements. It is an eye-opener in showing how standard and special designs can be combined ingeniously and economically to produce tailor-made installations that exactly meet specific conditions and requirements. With this book, you can profit by Gifford-Wood's hundred and twenty-six years of experience underlying the modern ideas illustrated.

If you have any project involving elevating, conveying, drying or baking, sheet or structural work, or require the manufacture of special equipment to your own specifications, get in touch with us. Our plant includes pattern, machine, steel, forge, paint and assembly shops—all ready to serve you.

As a first step, write for the new "Catalog No. 200"—more than a catalog—an idea-stimulator and source book you will value. It is yours upon request written on your business stationery.

GIFFORD-WOOD CO.
Founded 1814
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2110

frigeration industry, died at his home in Waynesboro, Pa., on Feb 2. He passed away just two weeks after his 86th birthday had been celebrated. He entered the Frick Works as an apprentice in 1875, and began an uninterrupted term of active service with the firm which he continued for more than 65 years. In 1880 the company moved its operations to a new plant on the west side of Waynesboro, and began to develop new machinery. By this time Ezra Frick had become foreman of the erecting department. He later became general clerk, and then purchasing agent. In 1896 he became general manager, which office he held until 1928, part of the time being both general manager and treasurer. As a pioneer in the refrigerating and ice-making industry, Mr Frick was one of the founders of the Ice Machinery Builders' Association of the United States, and became its secretary in 1908. He was president of the Refrigerating Machinery Association for the year 1919-20, and was elected honorary member of that association in 1936. He was one of the charter members of the American Society of Refrigerating Engineers, and was made its president in 1918. He was also a member of the American Institute of Refrigeration.

Midwest Power Conference Set for Chicago, April 9-10

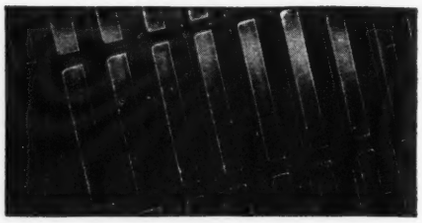
The Midwest Power Conference will be held on April 9–10 at the Palmer House, Chicago. This conference is sponsored by the Illinois Institute of Technology with the cooperation of the nine other midwestern universities and colleges and the local sections of the Founder and other engineering societies.

The directorate of the Conference, according to Stanton E Winston, director, cognizant of the fact that the need in the present war effort is power, and even more power, is doing its utmost to provide a program for this annual meetings which will not only uphold the tradition of the Conference but will also provide a stimulus in the present emergency. It is the opinion of the directorate that the present emergency makes the annual meeting of the Conference more urgent than ever before.

The preliminary program of the Conference will contain, in addition to the opening meeting, sessions on Electric Power Transmission, Industrial Power Plants, Hydro Power, Fuels and Combustion, Diesel Power, and Central Station Practice.

SAFE TRACTION *with* BATESGRATES
ELECTRICALLY PRESSURE WELDED

Non-slip, sharp top edge, self-cleaning cross bars like the ridge of a roof give you the maximum in safe traction. Other features your Batesgrate dollars buy are —maximum open area for light and air—no grooves or rough burned metal to catch grease or dirt—fillet weld, the strongest type—no cracks, joints, or crevices, therefore, easily maintained—smooth, clean appearance. Get all the important details from Catalog No. 937—Write today.



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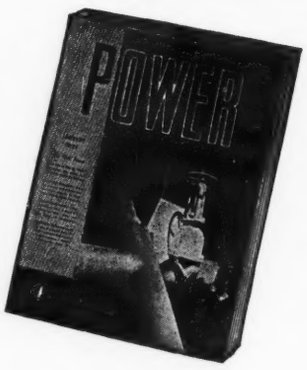


YOUR
Dependable Guide

. . . to the big things and little things done each month by operators and manufacturers across the country to raise plant efficiencies, cut costs, and reduce trouble.

It Pays You to
Read POWER Regularly

why 10 REASONS you can bank on FAIRBANKS

STANDARD AND RENEWABLE VALVES FOR PRACTICALLY EVERY SERVICE

Fairbanks has been developing valves to meet new conditions as they arose for more than 50 years. As a result of these specialized efforts, Fairbanks Valves are available today in a large variety of sizes and types.

You can "Bank on Fairbanks" to supply pretested brass and iron, standard and extra heavy valves designed to meet practically any operating condition. Specify "Fairbanks" on your next order.

Your Fairbanks' distributor is prepared to handle your needs promptly. Write for his name and catalog No. 21.

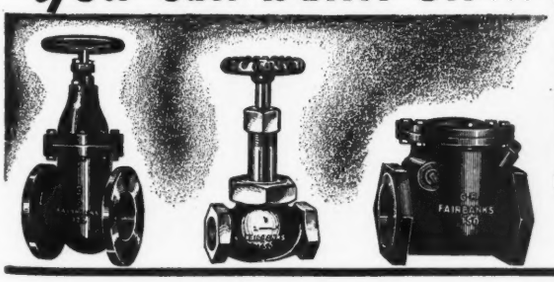
1. Prompt service through conveniently located distributors.
2. Standard and Renewable types for practically every need.
3. Quality in design, materials and workmanship.
4. Uninterrupted service.
5. Low in maintenance cost.
6. Maximum years of service assured.
7. Acclaimed for dependable performance.
8. Nationally accepted by users.
9. Backed by over 50 years' specialized experience.
10. Technical assistance in valve selection.

THE FAIRBANKS COMPANY

397 LAFAYETTE ST., NEW YORK, N. Y. BOSTON, MASS., PITTSBURGH, PA.

FACTORIES: BINGHAMTON, N. Y., ROME, GA.

You can bank on...

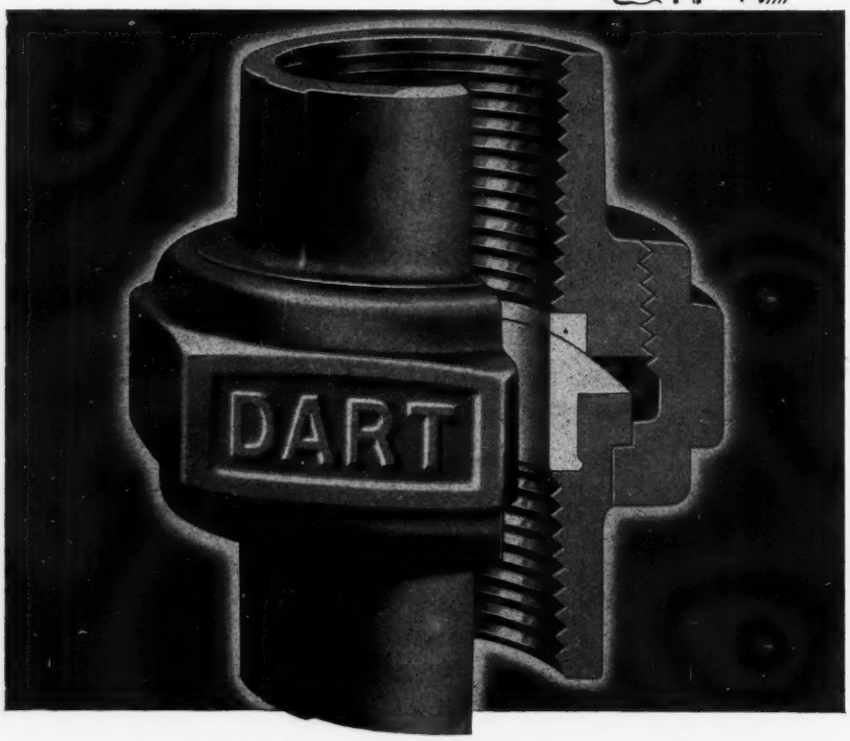


FAIRBANKS

as the RIGHT VALVES TO USE

LOOK

for the DARTS
you thought were through



and PUT THEM BACK TO WORK

The extra-value of Dart Unions has never been more fully realized than today—when the conservation of metal is so necessary. In fact, we are recommending to plants all over the country, that they make a search to locate used and discarded Dart Unions, so that they can be *put back on the job.*

You see, Dart Unions are engineered and made to be used again, again and again . . . providing "first-time" tightness each time they are installed. Matched bronze seats, ground to accurate "true-ball" surfaces is one important reason why Dart Unions can do this. *Another* reason is that Dart Bodies and Nuts are made of air refined malleable iron that resists pipe strains, rust and rough handling.

So, we suggest again: in the interest of metal conservation, search plant and pipe scrap-pile for *old* Darts: see your *supplier* for new Darts. Old or new a Dart comes through.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

MEETINGS

American Society of Mechanical Engineers—*Spring Meeting, Rice Hotel, March 23–25, 1942. Rice Hotel, Houston, Texas. C E Davies, secretary, 29 W 39th St., New York, N. Y.*

American Society for Testing Materials—*Spring Meeting, March 2–6, Cleveland, Ohio.*

Greater New York Safety Council—*13th Annual Safety Convention and Safety Equipment Exposition, March 3–6, Hotel Pennsylvania, New York, N. Y.*

THE BIRD-ARCHER CO announces the removal of their offices to 400 Madison Ave, New York, as of Feb 1, 1942.

THE MATHIESON ALKALI WORKS, INC, is observing its 50th anniversary. Incorporated in 1892 in Virginia, this company was first to manufacture bleaching powder in this country and pioneered in the production and marketing of alkalies, synthetic ammonia, and chlorine products.

110% Legion for Victory in American Industry

When the Allen-Sherman-Hoff Company, Philadelphia, asked their employees how many would voluntarily invest 10% of their wages in defense bonds for the duration of the war, the response was 100%.

The result was the formation of the 110% Legion. An insignia bearing the Victory "V," with "110 Legion" in the

center was created and Allen-Sherman-Hoff employees will wear this badge as evidence of their practical patriotism (see illustration).

The design is copyrighted but its use is offered free to any company who will certify that 100% of their employees are accepting 10% of their wages in Defense Bonds. A limited number of insignia buttons is available to those who address Allen-Sherman-Hoff Company at 227 South 15th St., Philadelphia, Pa.

GETTING THE *MOST* FROM YOUR THERMAL INSULATIONS...

NUMBER 2 in a series of messages to American industry devoted to conserving heat, improving operation and increasing production through modern insulation practice.

One reason why certain trees have a life span measured in centuries is that they are protected by bark that does not deteriorate with the passing of the years. Similarly, some insulating materials, such as Ehret's 85% Magnesia, have a proven record of long service life and a time-tested ability to maintain initial insulating efficiency.

Under the stress of present day demands on hot piping and equipment, it is all the more important to make certain that you specify only those insulations which have proven performance records.

★ **EHRET'S 85% MAGNESIA** and other Ehret heat insulating materials are fully treated from the standpoint of characteristics, selection and application in a new 176-page Heat Insulation Handbook. It will be sent, without obligation, to anyone interested in getting the most from thermal insulations. Write for your copy of Handbook A 203.

EHRET MAGNESIA MANUFACTURING CO.
VALLEY FORGE, PENNA.

...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

Control

American industry is geared up to the final test which will determine whether or not men, living under a government of their own making, can out-produce the slaves of the Dictator States. So gigantic an undertaking, to be successful, demands Control, sure — precise — unfailing. Control of the efforts of men, Control of the power that drives the machines and last, but not least, Control of the liquids and gases that play so important a part in the processes of modern production.

It is to this phase of Industrial Control that Powell engineers have long devoted their time, their exceptional skill and their years of experience. During this period they have created and put into use a vast array of valves, each one especially designed to perform some specific type of Control. These constitute the Powell Line as it exists today. Tomorrow there will be others, for every day there are new problems of Control which Powell Engineers are called upon to solve.

Thus it is that to the leaders of industry the name Powell represents a service rather than a product. Thus it is that the Powell organization recognizes and assumes the responsibility for the solution of such problems of Industrial Control as must inevitably appear in the great test of industrial strength and skill which war has demanded of our country.

The Wm. Powell Company
Cincinnati, Ohio

POWELL

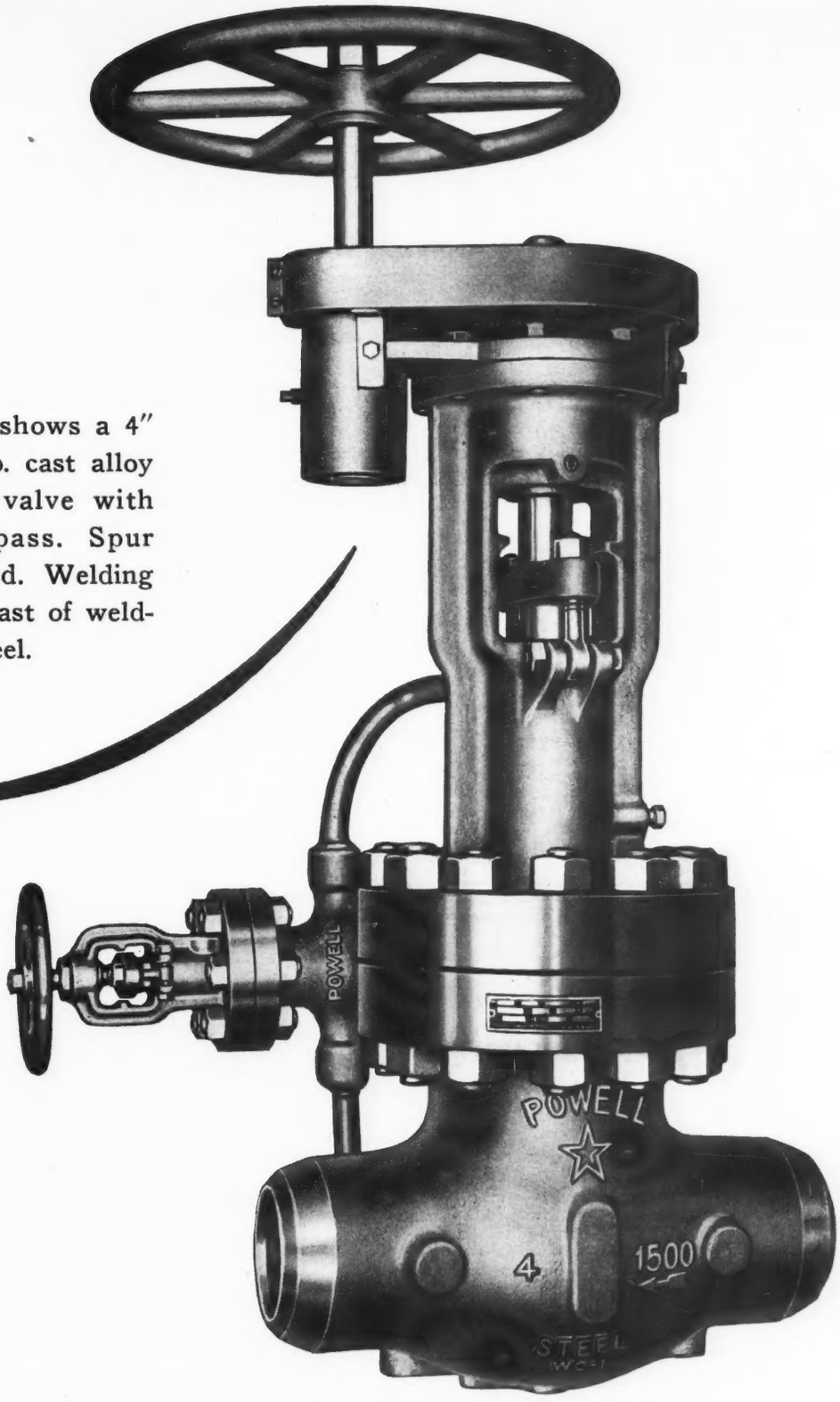


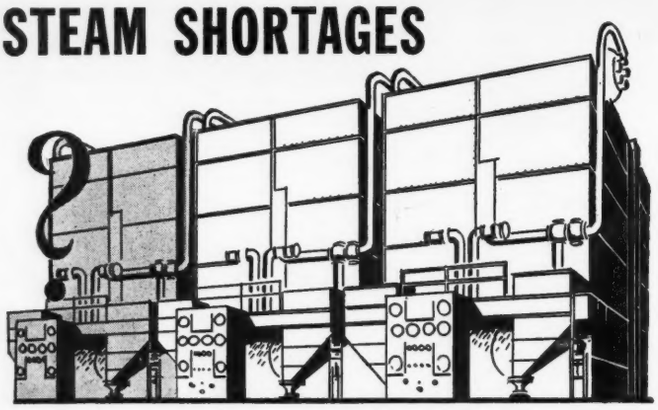
Illustration shows a 4" Class 1500 lb. cast alloy steel globe valve with welded by-pass. Spur gear operated. Welding ends. Body cast of welding grade steel.

VALVES

Shortages ... and

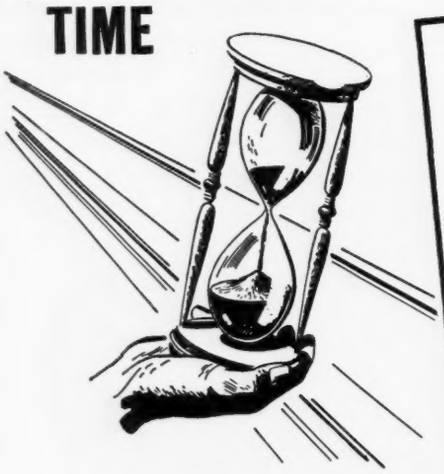
Shortages are *not* unavoidable . . . start remedying some of the causes!

STEAM SHORTAGES



Lack of boiler capacity is not the only cause. Poor combustion can reduce steam output as much as 5%. Hagan Automatic Combustion Control increases efficiency, helps you get those vital *extra* pounds you may think are unobtainable.

TIME



You can get new boilers in a year or more—*maybe*. Hagan Control can be installed in a few months—all that is needed in many plants to get over peak production hurdles.

EQUIPMENT

By improving combustion efficiency, Hagan Control not only lowers stoker and furnace maintenance, but reduces boiler outages as a result.

MONEY

Steam production costs are rising and may go higher. You can depend upon Hagan Control to help you keep them at a minimum.

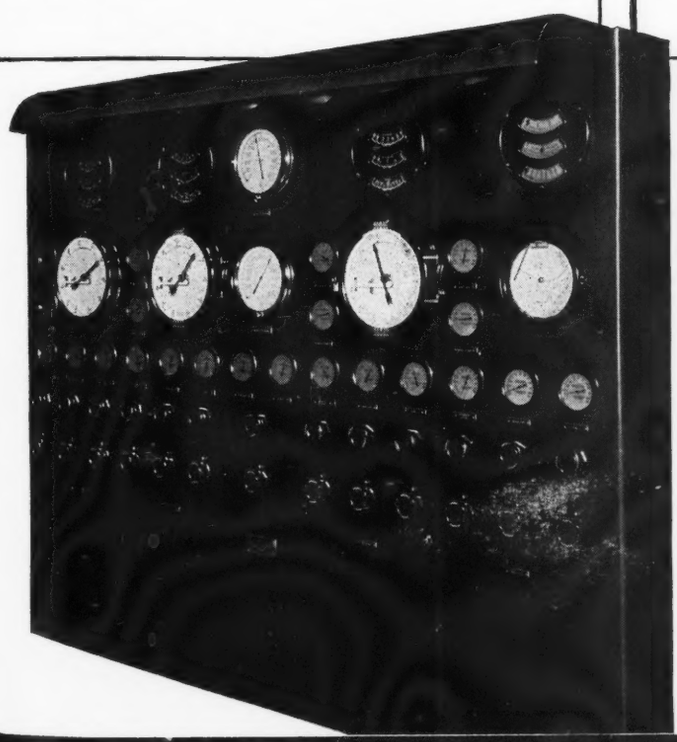
how to help whip them

FUEL SHORTAGES

"Go easy on the gas" is a common warning today, but what about coal and oil? Fuel shortages can strangle production almost overnight. Savings of 3% to 6% are not unusual with *fully* automatic Hagan Control.

MAN POWER

Skilled operators are scarce. It takes time to train green replacements. By maintaining top efficiencies *automatically* and *continuously,* Hagan Control is particularly valuable during periods when your plant is temporarily undermanned.



Faced with any of these conditions, look into Hagan Automatic Combustion Control. A relatively simple, low-cost installation often is the remedy. We will gladly survey your needs without obligation. Write today—it is *worth* the effort.

. . .

Coal consumption *decreased 6.7% per k.w.h. by this installation of Hagan Automatic Combustion Control in a medium-sized power plant. Savings paid for the installation in less than a year.*

HAGAN CORPORATION
300 ROSS STREET
PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

Compressed Air Will Increase Production

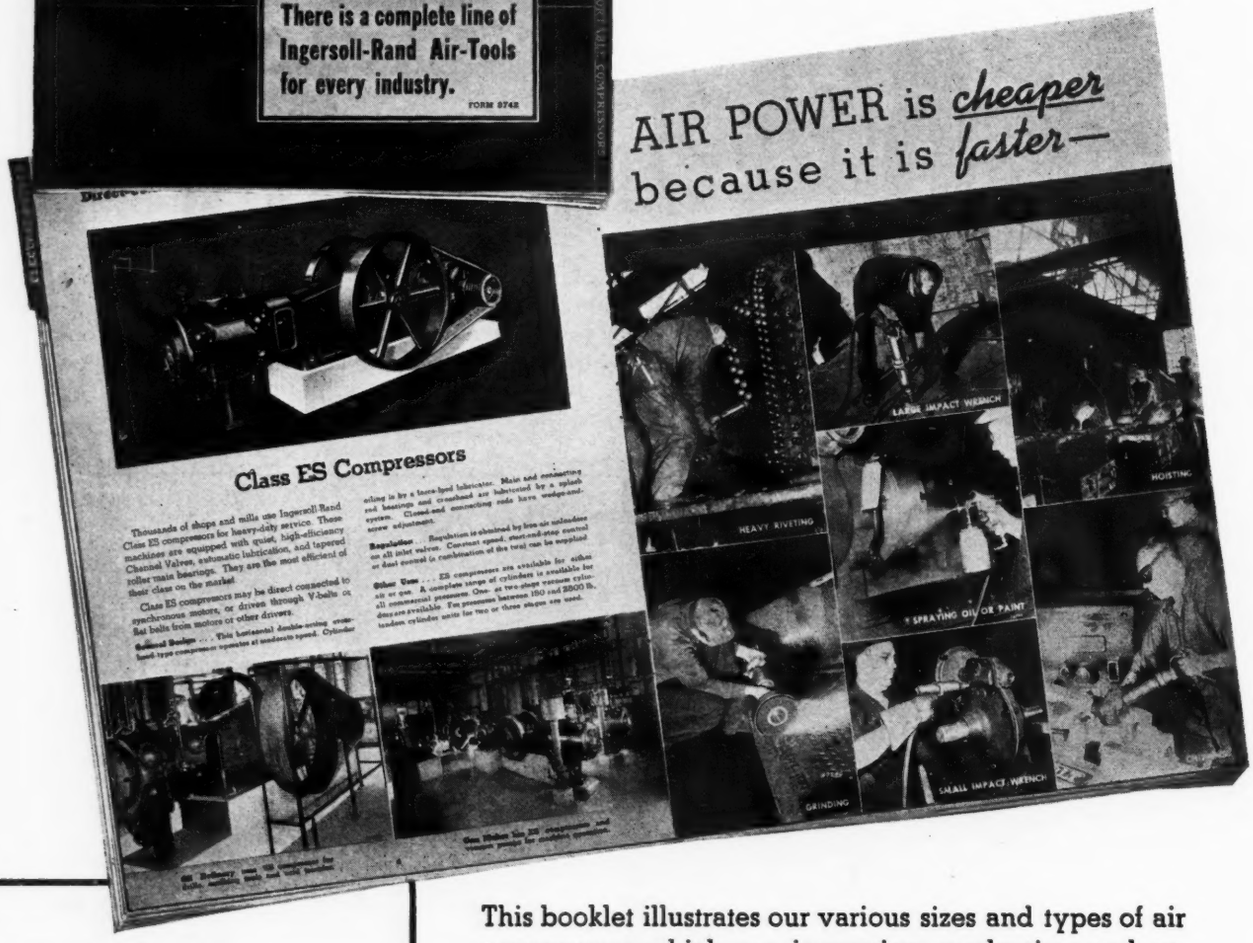
There is an Ingersoll-Rand Air Compressor for every plant use.

There is a complete line of Ingersoll-Rand Air-Tools for every industry.

FORM 2742

ELECTRIC DRIVEN

Ask for Your Copy



Ingersoll-Rand Co.
11 BROADWAY, NEW YORK, N.Y.

Please send me a copy of your new bulletin, "Compressed-Air Will Increase Production", Form 2742.

NAME_____

COMPANY_____

STREET_____

CITY_____ STATE_____

This booklet illustrates our various sizes and types of air compressors which are increasing production and reducing costs in thousands of jobs throughout industry.

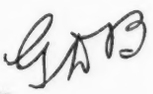
Perhaps there are some compressed-air applications with which you are not familiar or which you have overlooked. Our representative will be glad to help in every way possible.

Ingersoll-Rand
11 BROADWAY NEW YORK, N. Y. 1-133

To get the most value out of compressed air or exhaust steam, simply cut the pipe and install a

W-K-M MASTER SCRUBBER

The savings will really surprise you. And it's so easy to do. Clip the coupon for more information.

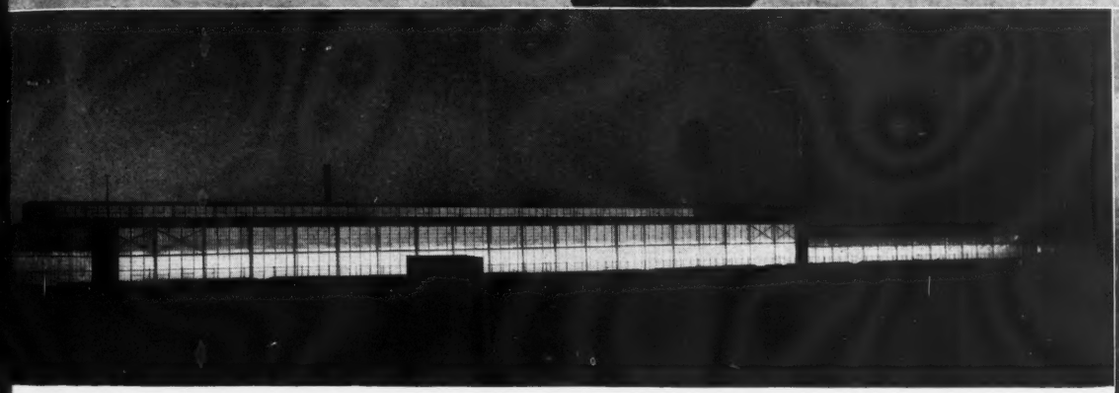


WICHITA

Keeps 'em

KANSAS GAS AND ELECTRIC COMPANY'S NEW RIPLEY STATI

AMERICAN BLOWER *Forced and Induced Draft Fans (at l and above), a part of the modern equipment of Ripley Stati*



PRODUCING *planes for victory, 24 hours a day—one of Wichita's many aircraft plants (above).*

Wichita, long a pacemaker for progress, is making a new name for itself! Already one of the "wheat capitals" of the nation — important, too, as a milling, oil refining, meat packing and dairy processing center — Wichita now has rolled up its sleeves to show the world how to "keep 'em flying." Four nationally known plane manufacturers have plants here — geared up to go. They've been "going great guns" a long time now. And the progressive Kansans operating these modern plants will tell you, "We've only started!"

Only by foresight and a background of progress can a city like Wichita move to the forefront with a new, complex industry in so short a time. The preparations date 'way back, and to the community as a whole belongs the credit.

Among those who have had a vital part in Wichita's planning for progress are the men behind the Kansas Gas and Electric Company. Decades of progressive management, constant growth and expansion, lie behind the company's ability to serve the 916 industrial customers, as well as 8,524 commercial and 65,141 residential customers in its wide field of service. We of American Blower are proud to have served the Kansas Gas and Electric Company by supplying Forced and Induced Draft Fans for its modern plants. Have you a problem involving Mechanical Draft, Dust Collecting or Fluid (variable speed) Drive? Write the nearest American Blower branch office for complete data.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, Detroit, Michigan
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
Division of American Radiator and Standard Sanitary Corporation

"X-Ray" Booklet Shows New Features of Improved Robins-Gyrex Screen;

Reader Builds Typical GYREX in Unique Catalog

Construction, Design Details Highlighted

Send for Free Copy, Using Coupon Below

PASSAIC, N. J.—Robins Conveying Belt Company, this city, has just released for free distribution a handsome "X-ray" type booklet which describes in an interesting and complete manner recent improvements and general information regarding the well-known ROBINS-GYREX Vibrating Screen. The new catalog (Robins Bulletin No. 115) is replete with unusual effects, all of which are successful in making plain to the reader the scientific design and rugged construction of GYREX Screens.

X-Ray Feature

In the first few pages of the new Bulletin, the various important parts of the GYREX Screen are printed on separate transparent sheets. Together these pages make up a complete screen, but taken separately they permit the reader to study each element of construction or design independently of the rest.

Installation Pictures

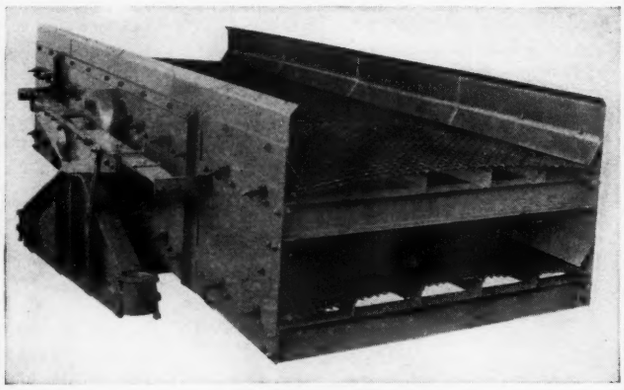
In the center of the new GYREX Bulletin is a colorful three-page spread which testifies to the versatility of GYREX Screens. In all, thirteen actual installations are reproduced, including Sand, Gravel, Coal, Coke, Limestone, Pebble Phosphate, Rip-rap and many other applications.

Complete Layout Dimensions

Complete dimensions with drawings for layout purposes are furnished in Bulletin No. 115, for both Cast Base and Steel Base GYREX Screens. Use the convenient coupon below and request your copy of the "X-Ray" Bulletin today.

DON'T WASTE MATERIALS. If you have not a bona-fide interest in these bulletins—please do not send for them.

Rugged, Vibrating Screen, Built for Hard Service



Robins-Gyrex, product of Robins Conveying Belt Company

Robins-Built Screen Line Is Complete

6 Different Types Cover Entire Screening Range

PASSAIC, N. J.—In addition to the GYREX, Robins Conveying Belt Company manufactures the VIBREX, a high speed, unbalanced vibrator for fine sizing. Bulletin No. 118 describes this popular unit.

The ROBINS-ELIPTEX Screen is ideal for horizontal installations where headroom is limited, or for dewatering service. Bulletin No. 111.

ROBINS-LIQUID Screens for clarifying liquids or dewatering solids are used in dozens of highly diversified applications in the process industries. Bulletin No. 107.

The ROBINS-CONTRACTOR'S Screen is a small, portable, general purpose unit. Bulletin No. 110.

ROBINS FOUNDRY SHAKEOUT Screens are made for both continuous or pick-up operation.

Please send a copy of your new "X-RAY" Bulletin to—

Name_____

Address_____

ROBINS CONVEYING BELT COMPANY
Passaic, N. J.

9 Reasons for GYREX Popularity

These Features Fully Described in X-Ray Bulletin

PASSAIC, N. J.—The following are reasons why so many hundreds of operators choose GYREX Screens;

1. Simplicity of design, the result of experienced engineering—means RELIABLE PERFORMANCE.

2. Super-sealed bearings and heavy duty structure—for LOWER MAINTENANCE.

3. Central vibrator location and balanced stabilizing springs, insuring uniform, positive motion—a guarantee of HIGH CAPACITY and EFFICIENCY.

4. Minimum number of easily accessible cloth attachment bolts and ability to flatten live frame to clear chutes—providing SPEEDY CLOTH CHANGE.

5. Positive eccentric shaft and massive anvil-type base frame—which means ABILITY TO STAND UP TO OVERLOADS.

6. Easy access to mechanical parts and guaranteed interchangeability of replacements—make GYREX EASY TO SERVICE.

7. Spring tensioned cloth supported on rubber cushioned arched frame prevents whipping and crystallization — providing LONG CLOTH LIFE.

8. Screw adjusted counterbalance weights—which mean PERFECT BALANCE WITH NO ESCAPING VIBRATION.

9. The wide range of sizes and styles available enables Robins engineers, guided by their broad background of experience, to make the most suitable recommendations—making certain of PROPER APPLICATION.

Gyrex Famous in Many Fields

Versatile Screen Is Positive Stroke Circle-Throw Type

PASSAIC, N. J.—Unsurpassed in versatility of application and in stamina, ROBINS-GYREX Screens are built in a complete range of sizes from 24" x 54" to 72" x 192". The latter are the largest and heaviest vibrating screens in the world. (See picture below). Standard units are available with one, two or three decks; with heavy, cast base and angle adjustment for floor mounting or with steel base for suspended or rigid mounting.

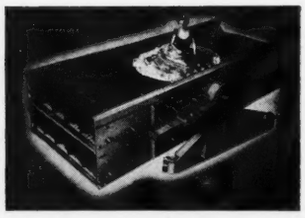
Quick-Change Attachment

This special feature available on GYREX Screens cuts the time required for cloth changes to an absolute minimum. It is a particular boon to operators who must change cloth frequently to produce products of varying specifications.

Robins Screen Cloth

New Robins Bulletin No. 113 is a fact-full illustrated story of the complete selection of Robins Woven Wire Cloth for Vibrating Screens. The bulletin contains helpful data on cloth specifications, wire diameter, comparison of round with square openings, etc. Pictures of various Robins weaves and cloth-holding methods are also shown. Copies of Bulletin No. 113 are available without charge.

World's Largest Screen



This picture was taken at Robins Passaic, N. J. works. The Screen is a ROBINS-GYREX 72" x 192".

MORE POWER FOR VICTORY

Transmission units equipped with Timken Bearings are keeping power going through for the Victory Program. Their power-saving, cost-reducing qualities will help protect profits in the days of reconstruction.

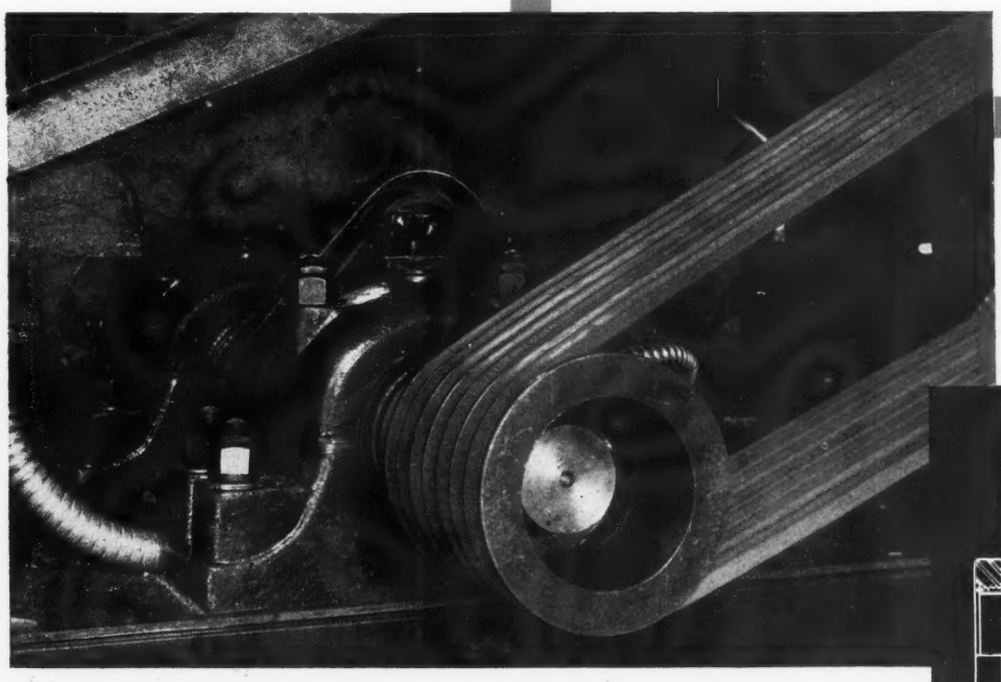
Dodge-Timken Pillow Blocks and Line Shaft Hangers are doing a splendid job transmitting power for many purposes in connection with armament production. They have a record of efficiency and economy stretching back for many years and embracing all industry.

The combination of modern design and Timken Bearings produces transmission units that transmit power without waste; simplify lubrication; prevent lubricant leakage and consequent contamination of product.

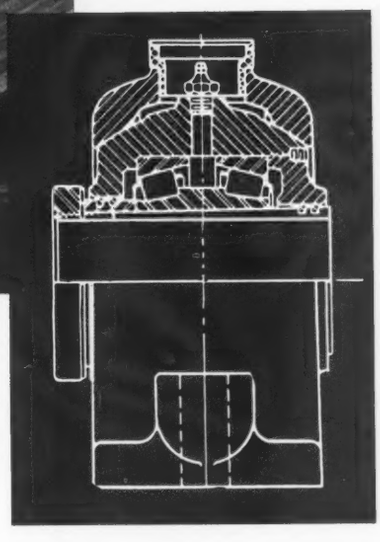
Are you paying for power you don't use? It will pay you to check up now. Obsolete power transmission equipment is a serious liability in any plant.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Dodge-Timken Special Duty Pillow Blocks on Dodge "DV" Drive operating Wheelabrator "Tum Blast".



Application of Timken Bearings in Dodge Special Duty Pillow Blocks.

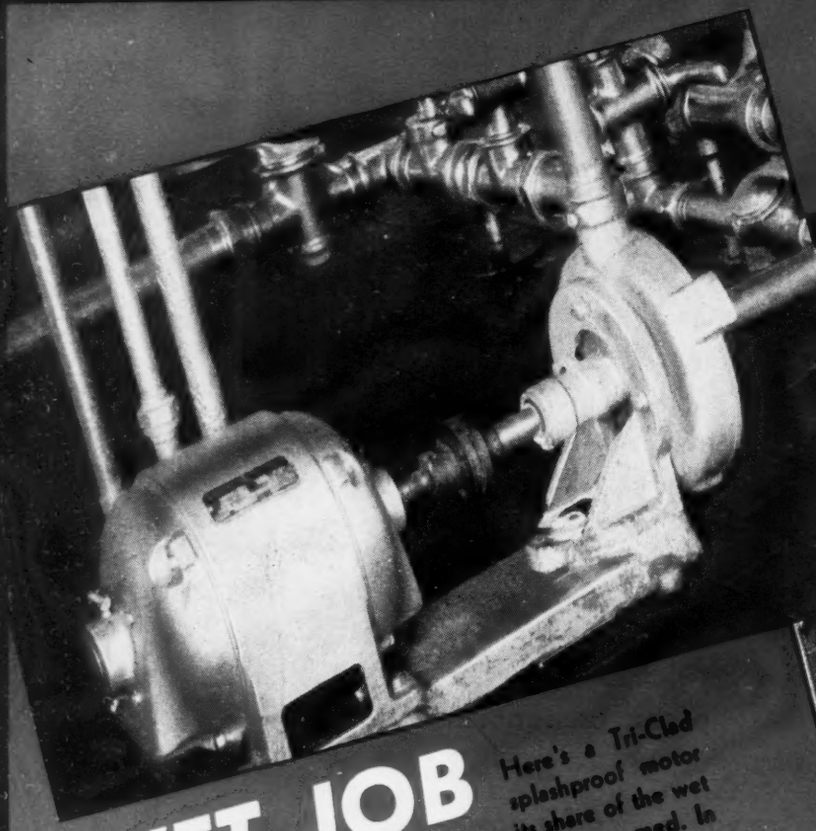


TO ASSURE VICTORY BUY UNITED STATES DEFENSE BONDS & STAMPS

TIMKEN

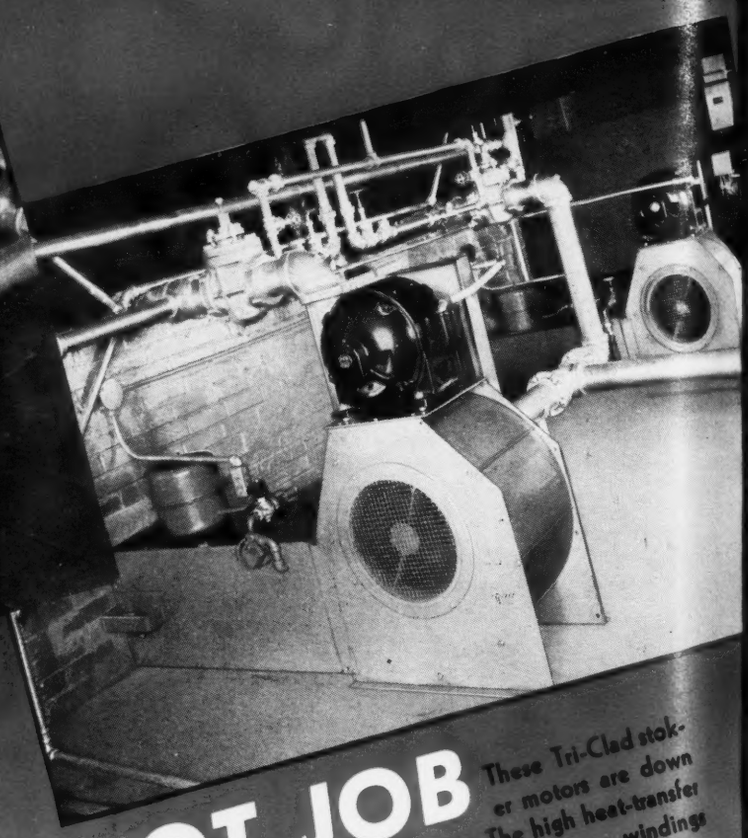
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



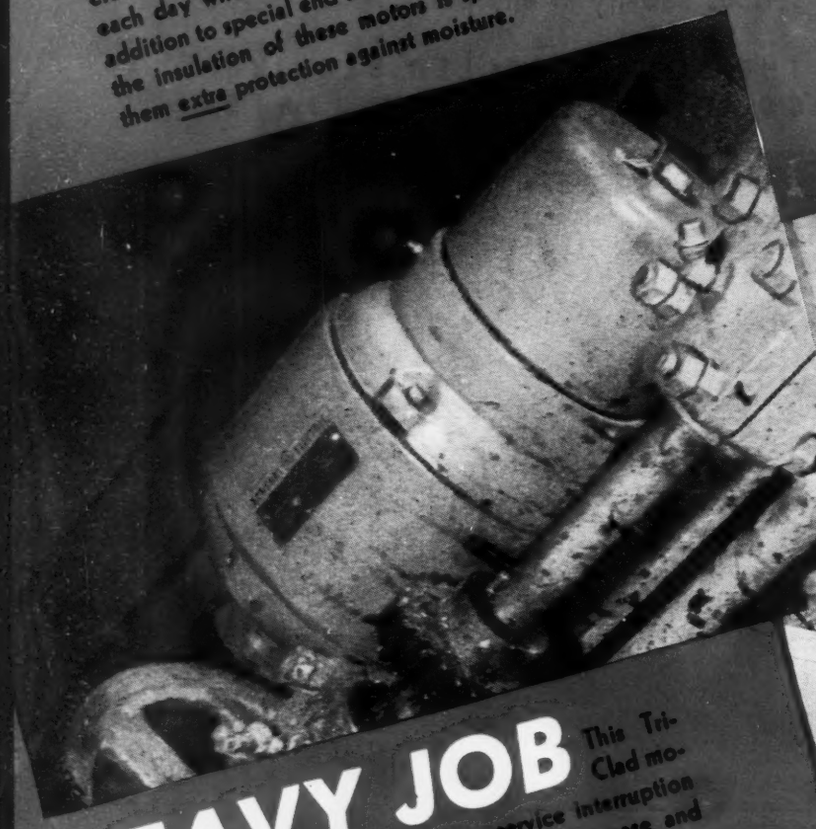
WET JOB

Here's a Tri-Clad splashproof motor close to the floor in a dairy plant. It gets its share of the wet each day when pipes and floor are cleaned and steamed. In addition to special end shields and watertight conduit boxes, the insulation of these motors is specially designed to give them extra protection against moisture.



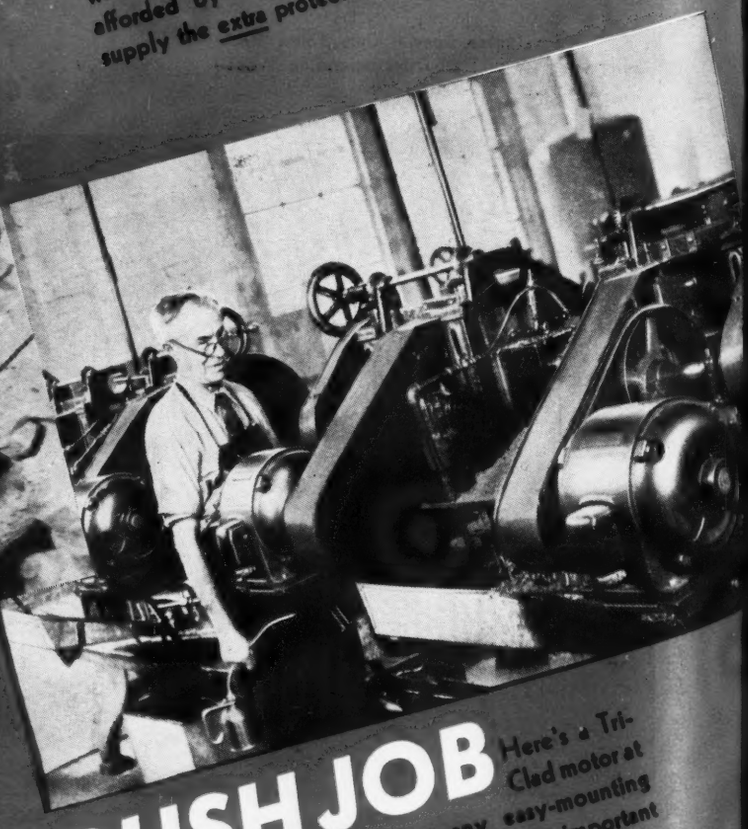
HOT JOB

These Tri-Clad stoker motors are down where red-faced firemen used to sweat. The high heat-transfer afforded by double-end ventilation and Formex windings supply the extra protection needed for this service.



HEAVY JOB

This Tri-Clad motor is installed on a lift bridge, where a service interruption could be serious. In these surroundings, where grease and grime are to be expected, a protective frame is an important factor in continuous operation.



RUSH JOB

Here's a Tri-Clad motor at work in the arms industry. The many easy-mounting features of Tri-Clad motors can help plants get important tools into operation quickly. Their extra-protection features will help keep vital equipment in triple-shift operation.

BUILT FOR PROTECTION FIRST . . . . TO LAST!

BIG JOB On machine tools vital to America's war effort, Tri-Clad motors are well guarded against falling metal chips or dripping coolants by their own sturdy, cast-iron frame and end shields.

DIRTY JOB Note how dust and fumes have coated this Tri-Clad ball-bearing motor. While this is service for which we do not recommend open motors, such as that shown, we are glad to chalk up this instance of motor stamina under severe operating conditions.

TODAY'S TOUGH JOBS CALL FOR TRI CLAD MOTORS

REG. U.S. PAT. OFF.

NOW more than ever, you must be sure that your motors give you 24-hour operation, even on the *toughest* jobs. Here's where Tri-Clad motors can be a real asset — their *extra protection* features* give them the stamina necessary to keep your equipment in operation in spite of adverse operating conditions.

The Tri-Clad motor's cast-iron frame and end shields are a safeguard against accidental blows—they shield the motor from falling objects and dripping liquids. The stator winding, of Formex wire, is proof against damage from oil, moisture, and heat shock. Improved bearings are easily lubricated, and are sealed against the entry of dust or dirt by complete enclosure in cast iron.

All in all, these protection features are sound assurance of an *extra tough* motor for use on equipment that can't be allowed to quit on the job. Ask your G-E representative for details on types and sizes now available, or write General Electric, Schenectady, N. Y.

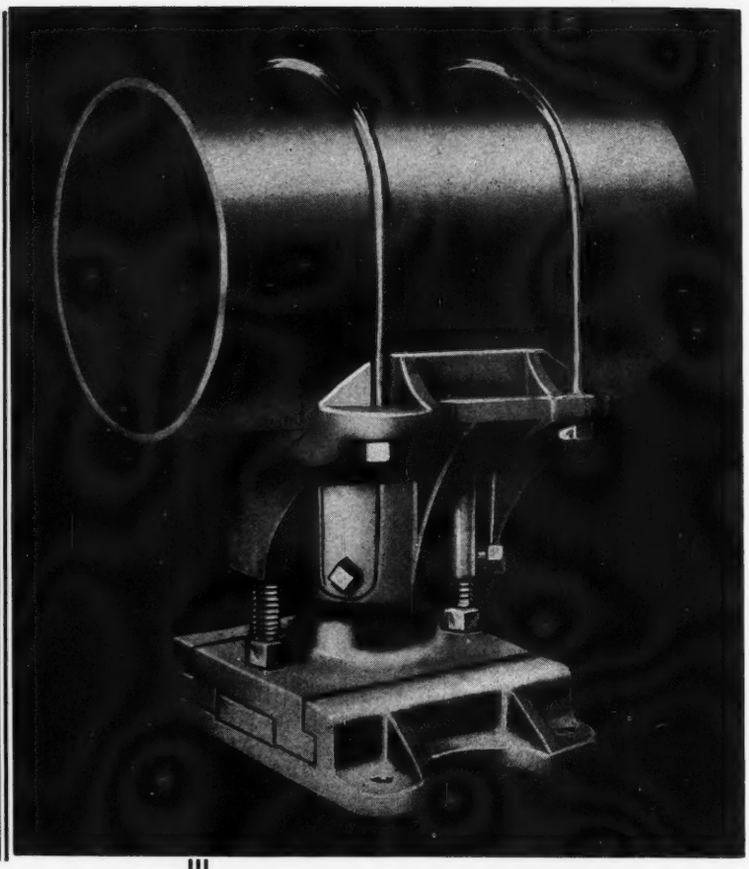
*Extra protection against physical damage, electrical breakdown, and operating wear and tear.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

750-112-8058

NAVCO *"UNIVERSAL"* PIPE SUPPORTS



Navco Universal Support will take care of eight inches of expansion and can be made special to accommodate any amount of travel.

Vertical adjustment up to 2½ inches can be made.

Support may be turned to any angle of 360°.

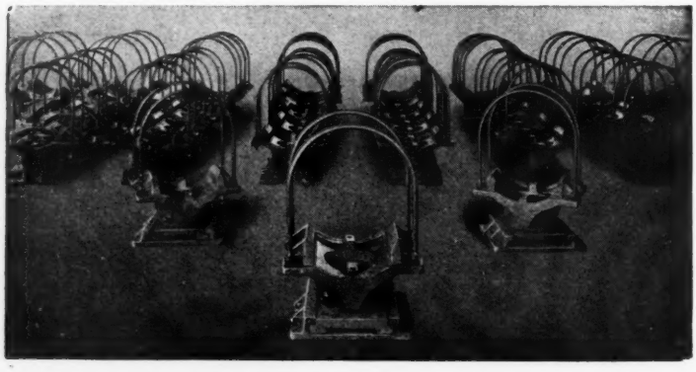
Holds pipe down as well as up. Prevents pipe from getting out of alignment, which is usual in the Roller Type of support.

It permits control of expansion movement of pipe and insures the desired free action of Slip Expansion Joints so essential in tunnel and duct work.

Carrier is fixed to a predetermined point on the pipe, thereby eliminating possibility of destroying insulation. There is a recess in the saddle for insulation and the entire support can be insulated on the outside.

Navco Universal pipe supports are made of cast iron but can also be furnished in steel at increased prices. For installations exposed to the weather, bases can be furnished with brass liners or provided with forced lubrication.

A recent shipment of "Universals" for high Pressure Central Station Service.



NAVCO

POWER PLANT PIPING

Navco Shops are equipped to furnish a complete power piping service, from field measurements to finished installations.

NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA

PREPAREDNESS *plus* **CONSERVATION** *with the* **RIGHT** *product in the* **RIGHT** *place*

THE *Less* SERVICE THE BETTER . . THESE DAYS

American industry can't afford breakdowns during these critical days, because servicing takes *time*, and that precious element can't be spared by anyone.

That's why engineers are specifying Flexible METAL Hose and Tubing on defense jobs. Metal is the universal symbol for strength, enduring performance, and permanence. Where breakdowns just can't be tolerated at flexible connections, METAL tubing is the logical answer.

It will pay you to know the unique qualities of *modern* Flexible METAL Hose and Tubing . . . and the wide range of types available. Send for your copy of the Flexible METAL Hose and Tubing "Fact Book".

The Flexible Metal Hose and Tubing Institute
150 Broadway P-12 New York, N. Y.

Please send me, without obligation, copy of your "FACT BOOK"

NAME.....

COMPANY.....

TITLE.....

ADDRESS.....

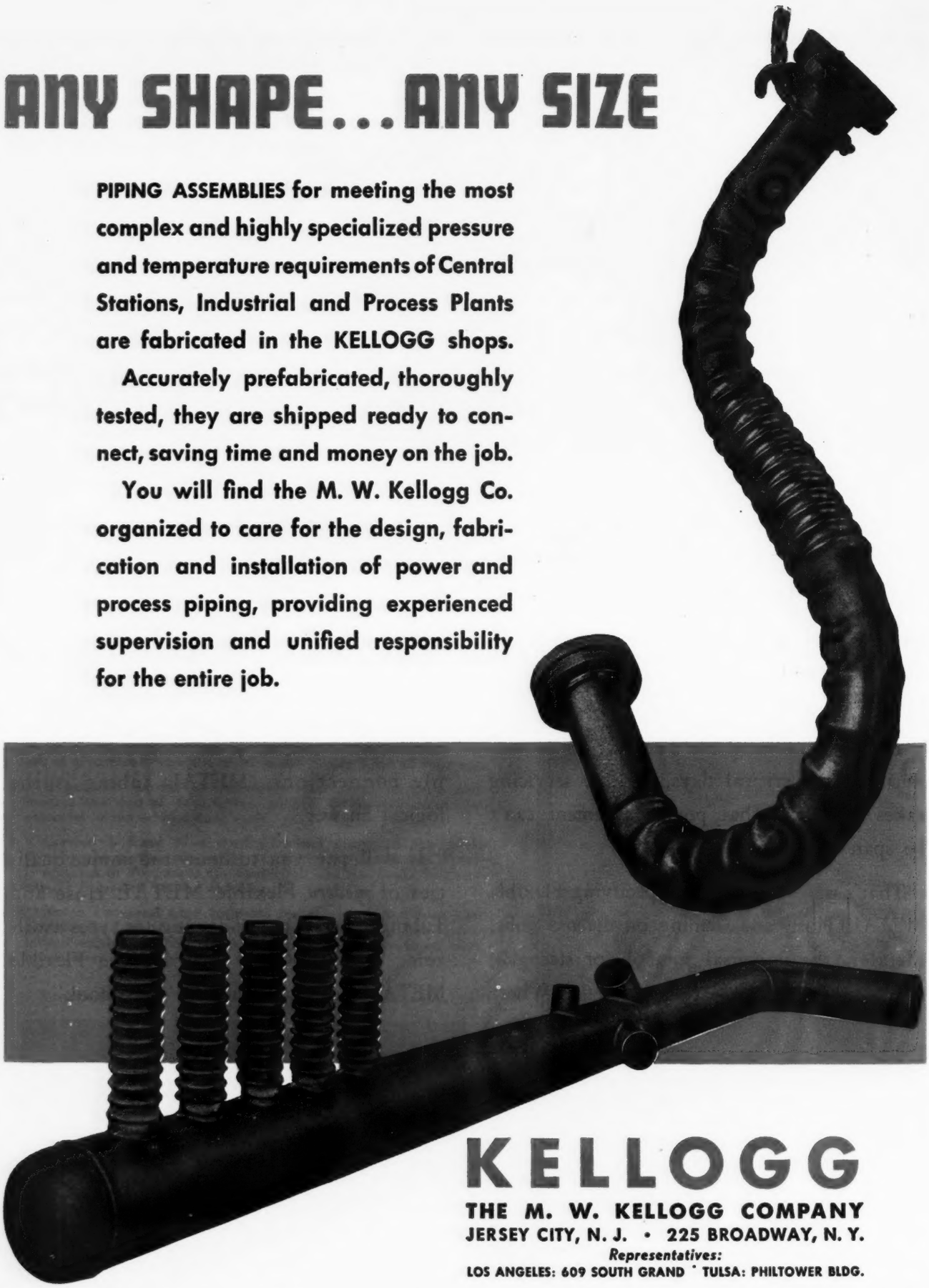
CITY..... STATE.....

ANY SHAPE...ANY SIZE

PIPING ASSEMBLIES for meeting the most complex and highly specialized pressure and temperature requirements of Central Stations, Industrial and Process Plants are fabricated in the KELLOGG shops.

Accurately prefabricated, thoroughly tested, they are shipped ready to connect, saving time and money on the job.

You will find the M. W. Kellogg Co. organized to care for the design, fabrication and installation of power and process piping, providing experienced supervision and unified responsibility for the entire job.



KELLOGG

THE M. W. KELLOGG COMPANY
JERSEY CITY, N. J. • 225 BROADWAY, N. Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND • TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization, Thermal and Catalytic Polymerization Units JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

CORRECT FUEL FEED

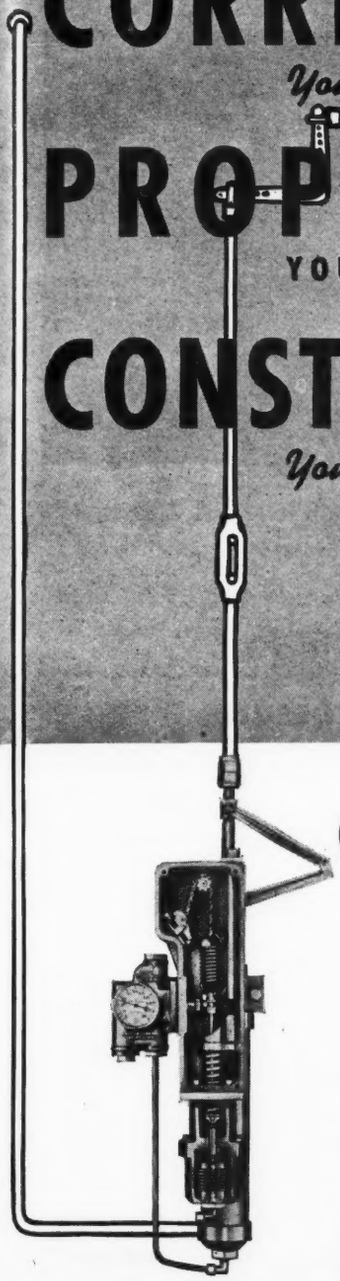
You Save COAL, OIL OR GAS

PROPER AIR SUPPLY

YOU BURN FUEL *Economically*

CONSTANT OVER-FIRE DRAFT

You Prevent UNDUE STACK LOSS



FURNACE DRAFT CONTROLLER
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

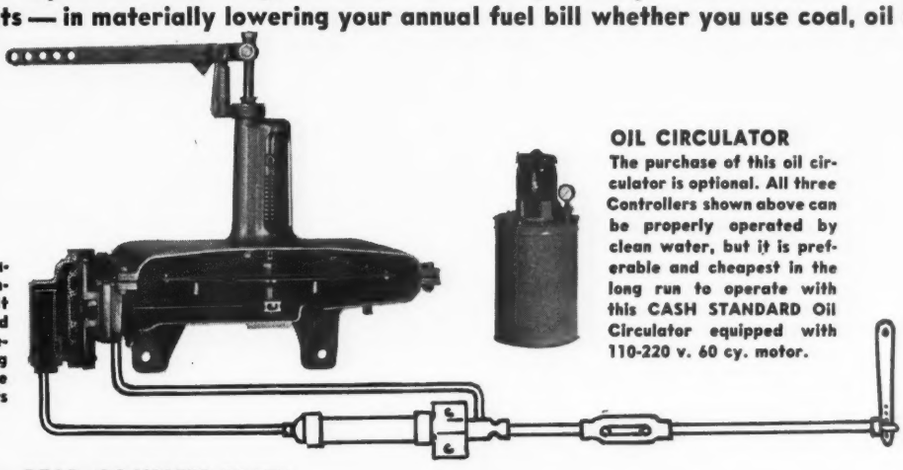
CASH STANDARD

AUTOMATIC COMBUSTION CONTROL SYSTEMS

Give you these three advantages for Steam Plant Economy . . . .

Here is simple, easily applied automatic combustion control that works as efficiently on multiple-boiler batteries as on single boilers. CASH STANDARD units, which make up the Systems, are available in a number of variations. Combinations of these units can be arranged to give you the fullest results — in boosting boiler output — in economy of operation — in lowest cost maintenance — in reducing the fuel requirements for a given load — in holding steam pressure to within very close limits — in materially lowering your annual fuel bill whether you use coal, oil or gas.

FUEL FEED CONTROLLER
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



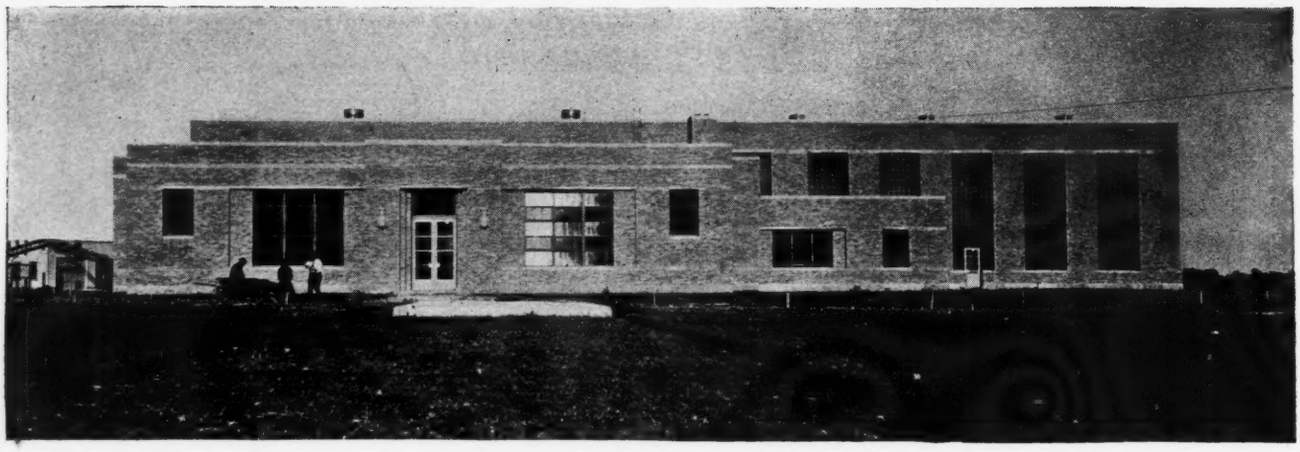
AIR FLOW CONTROLLER
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

OIL CIRCULATOR
The purchase of this oil circulator is optional. All three Controllers shown above can be properly operated by clean water, but it is preferable and cheapest in the long run to operate with this CASH STANDARD Oil Circulator equipped with 110-220 v. 60 cy. motor.

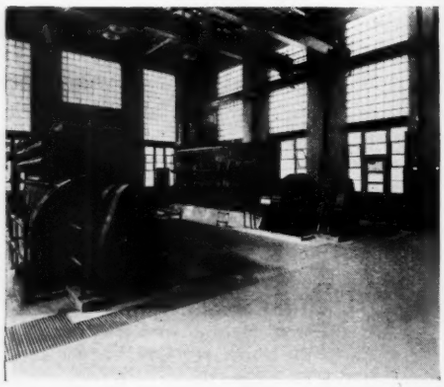
Send for Bulletin 300 • READ COMPLETE FACTS ON APPLICATION AND OPERATION

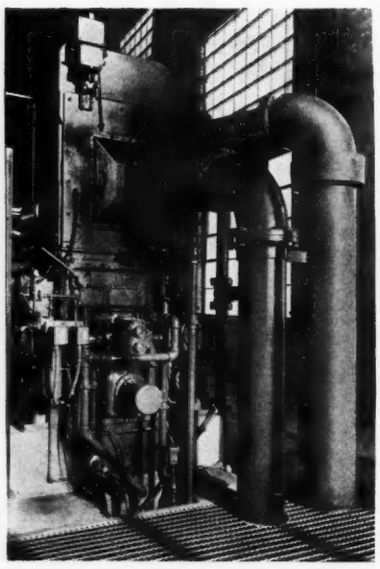
A. W. CASH COMPANY
DECATUR, ILLINOIS

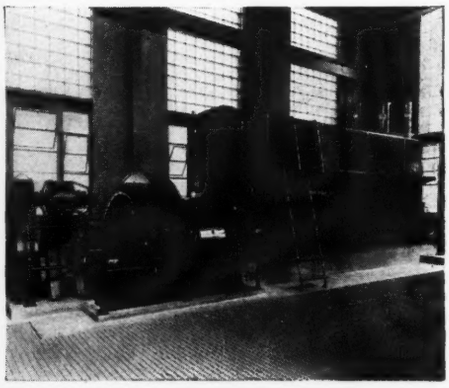
CASH STANDARD
CONTROLS . . VALVES



Superior **DIESELS** are installed as stand-by power in the low pressure service pumping station of the new Toledo, Ohio, Lake Erie Water Supply System. Two 14½"x 20", 900 H. P. dependable Superiors are assurance against failure of this vital essential in the health and happiness of 400,000 people.



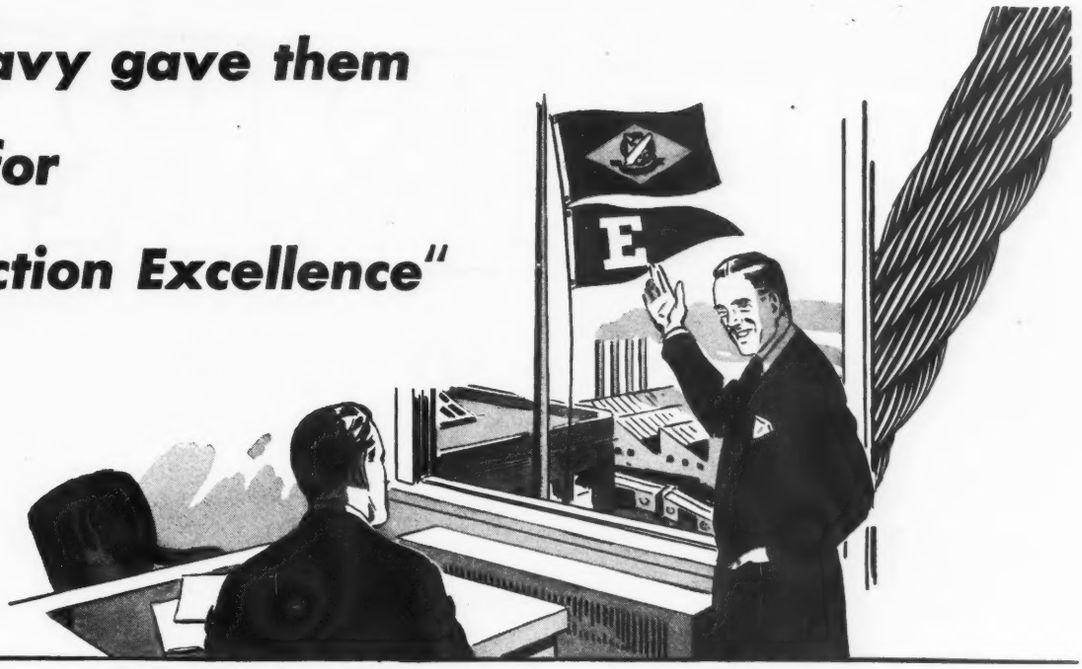




THE NATIONAL SUPPLY COMPANY... SUPERIOR ENGINE DIVISION

SALES OFFICES: Springfield, Ohio; Philadelphia, Penna.; New York, N. Y.; Los Angeles, Cal.; Jacksonville, Fla.; Houston, Texas; St. Louis, Mo.; Fort Worth, Texas; Tulsa, Okla.; Boston, Mass. FACTORIES: Springfield, Ohio; Philadelphia, Penna.

"The Navy gave them to us for Production Excellence"



They're owned by 7000 people who pulled together, working hard

"Out there on the Roebling staff you see two emblems. The top one, bearing the crossed cannons, is the Naval Ordnance flag. And below that is a pennant, **"E"** ... the United States Navy's flag of Excellence. The Navy "E" is something to be strived for—at sea, in peacetime, officers and men must work all year to reach the standard of excellence that bestows an "E" on a stack, for engineering; on a turret, for gunnery; on a radio shack, for communications. Ashore, it's given with the Ordnance flag for another kind of excellence — the kind you get from seven thousand heads and fourteen thousand hands that Roebling stands for ... Production Excellence.

When the Navy gave these flags to Roebling, they also pinned an "E" on every man-jack of the Roebling crew. You'll see it proudly worn by the men who are today filling your wire rope needs. They're working with the pride and satisfaction of master-craftsmen, knowing they have pleased one of the world's most demanding customers, just as they'll please you.

The men who man the open hearths are putting something extra into every melt of Roebling "Blue Center" Steel. Something they gained the day they got their "E", when they watched these same hearths swallow a fragment of enemy bomb from the hand of a Naval officer, to be returned with interest to those who menace American liberty.

You'll get that "something extra" if you're in the Navy, using Roebling Wire Rope for any one of its multitude of shipboard purposes, such as the slings that hoist a plane aboard its mother ship.

You'll get it also if you're buying Roebling "Blue Center" for any of the vital industrial uses that must go night and day, non-stop ... for logging camps, for mines or elevators, for plant hoists or oil well drilling lines. You'll get it every time you use the Roebling trade-mark as your buying guide."

JR ROEBLING

Roebling Research, plant facilities; Roebling Quality Control and Engineering ... for years they've been putting extras into "Blue Center" Wire Rope. Extras that you need today, wherever wire rope has a dependable, long-lived job to do.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

THAT'S THE ONLY WAY TO MAKE

ROEBLING

"Blue Center"

STEEL WIRE ROPE

PREFORMED OR NON-PREFORMED

TERRY

AN URGENT MESSAGE ABOUT TERRY TURBINE REPLACEMENT PARTS AND THE WAR EMERGENCY

The coming of active warfare makes it doubly essential that we conserve vital materials to the utmost.

We therefore urge all Terry Turbine users to:

- ★ Refrain from ordering unnecessary replacement parts.
- ★ Repair the old part if possible and make it do.
- ★ Keep spare part supplies down to a minimum.
- ★ And above all things not to overstock.

If all our customers will adhere to this policy, vital materials as well as valuable man hours will be saved for our defense work.

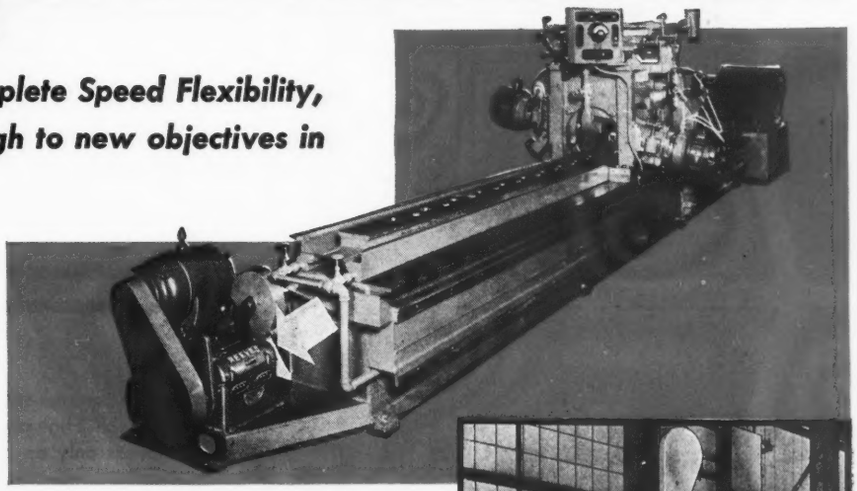
We earnestly solicit your cooperation.

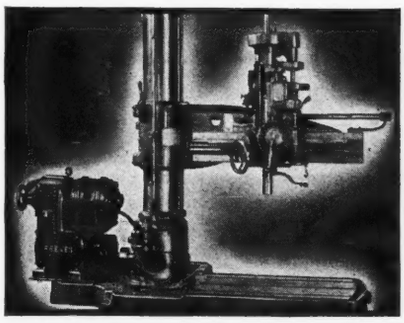
T-1140

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

SPEED OF A *Machine* MAY BE AS IMPORTANT AS THE SPEED OF A *Tank!*

● ***When a machine has Complete Speed Flexibility, you can quickly break through to new objectives in defense production . . .***





DRILL PRESS EQUIPPED WITH REEVES MOTODRIVE

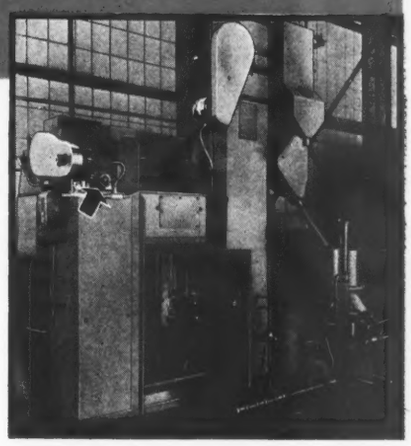
Size of drill, gauge and hardness of metal —*all* influence the speed at which a drill press should be operated, for best results. Presses with inadequate speed control are obviously limited in capacity and variety of work. On the other hand, the radial drill press as shown above, rebuilt by the Louis E. Emerman Co., Chicago, and equipped with a REEVES Vari-Speed Motodrive, is so versatile and flexible it is running continuously in a big armament plant. The "switch over" from one job to another is effected merely by turning a handwheel. The exact speed is so easily attained that REEVES-equipped machines are widely preferred by management and operators.

CUTS TIME FROM 60 HOURS TO 42 MINUTES

This spar milling machine (above) with REEVES Transmission and Electric Remote Control, built by Farnham Manufacturing Co., Buffalo, N. Y., now does in 42 minutes work that used to require 60 hours. On each spar milled, the section varies from end to end. By means of the REEVES Transmission the feed can be adjusted to conform to the various sections and optimum results can be obtained at all points, gradually and without stopping the machine. On high speed milling any jerk in the feed damages the cutters, which run at 3500 r.p.m. with feeds up to 240 inches per minute.

NEW RECORDS SET IN CLEANING SHELLS

Munition shells are blasted with abrasives to clean thoroughly exterior and interior surfaces and, naturally, the speed of the conveyor carrying the shells through the machine must be accurately timed for different shell sizes. This new American Foundry Equipment Shell Blasting Machine is accordingly equipped with a REEVES Vari-Speed Motor Pulley which provides any speed desired and new records for fast processing. No changing of gears, belts, or pulleys is necessary.



NEED HELP? This company maintains a nation-wide staff of factory-trained speed control engineers, located in strategic industrial centers. Their advice and counsel is offered, without obligation, to help speed our defense program. Write, wire or phone REEVES PULLEY CO., Columbus, Indiana.

★ ★ ★

REEVES PULLEY COMPANY

Recognized Leaders in the Specialized Field of Speed Control Engineering

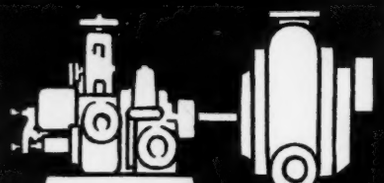
COLUMBUS, INDIANA

REEVES *Accurate Positive* SPEED CONTROL

FACTS To Help You Select the RIGHT

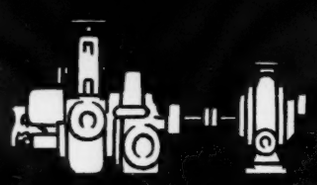
BOILER FEED PUMPS

In selecting boiler feed-pump drives, continuity of service should be the first consideration. Type D variable-speed turbines with constant-pressure regulator (speed of the turbine automatically adjusted to maintain a constant discharge pressure from the pump) or with differential-pressure regulator (turbine speed automatically adjusted to maintain pump pressure at a predetermined pressure above boiler pressure) are recommended. Operation can be either condensing or noncondensing.



Constant-speed Type D turbines with reduction gears meet the severe, long-life requirements of power plant condenser duty. Turbine drives make possible prompt restoration of service after electrical disturbances because the vacuum in the condenser can be maintained.

HOT WELL AND CONDENSATE PUMPS



Where constant-speed drives are required, turbines offer inexpensive operation. High availability factor is assured because turbine operation depends only on a supply of steam. Operation may be either condensing or noncondensing.

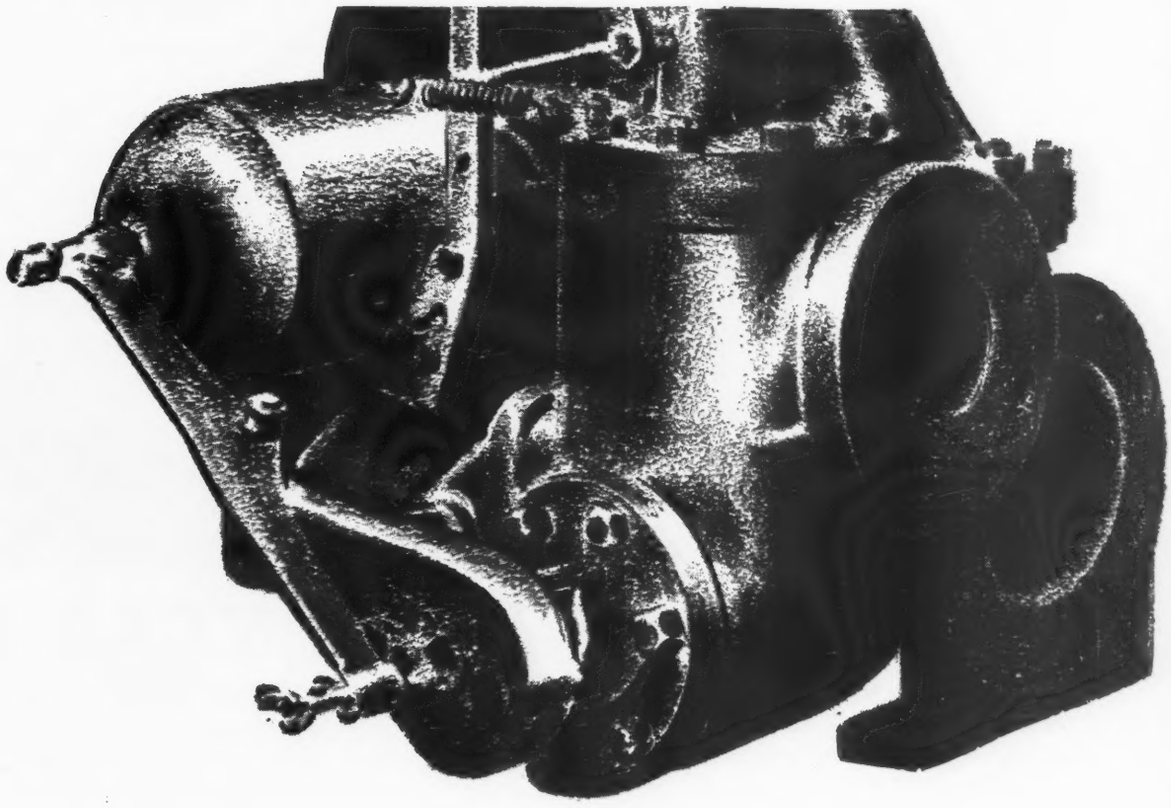
Continuity of operation should be the first consideration in all essential induced- or forced-draft fan drives. Variable speed and the ability to withstand high ambient temperatures are two primary reasons for selecting mechanical-drive turbines for this service. Combustion control is recommended for automatically controlling speed to obtain the best fuel-air ratio and draft.

COAL PULVERIZERS

Constant-speed mechanical-drive turbines with inherent, high starting torque are correct for coal pulverizers. Turbines keep going even when adverse operating conditions exist, such as high ambient temperatures and dusty or abrasive atmospheres.

Mechanical-drive turbines assure continuity of service and a positive source of excitation for prime movers. Normally, the exciter is driven by the motor but when power is interrupted the turbine picks up the load automatically. Turbines will also divide the load with the motor to improve station heat balance.

TURBINE DRIVE for POWER-PLANT AUXILIARIES



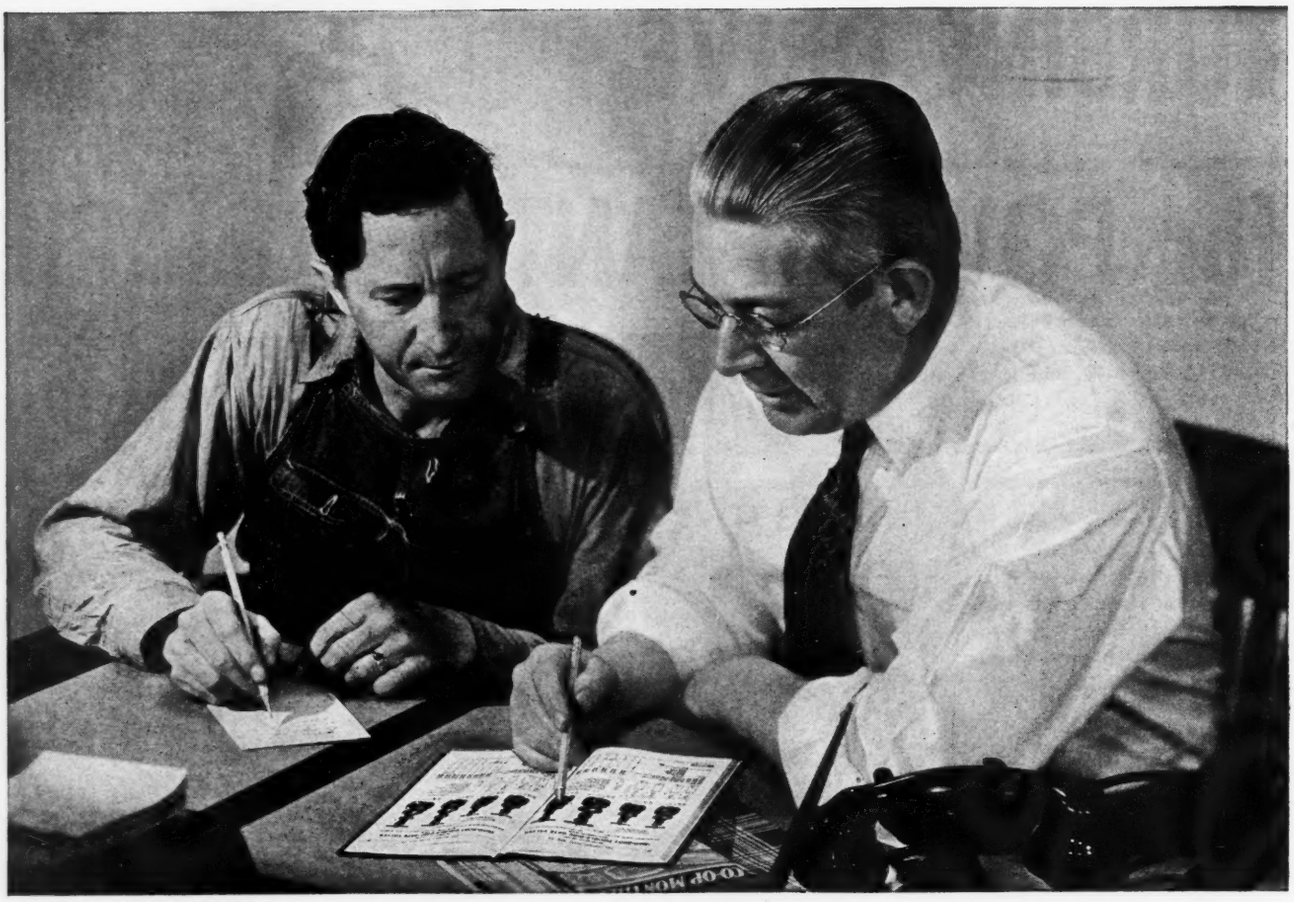
IN OUR complete war effort, many power plants are being driven at rates that severely test the reliability of their auxiliary drives. Now, more than ever before, these drives should be so designed and built that they will withstand continuous, gruelling punishment. General Electric Type D mechanical-drive turbines provide a high degree of immunity from any difficulties that would jeopardize 24 hours-a-day, 7 days-a-week operation.

When the *right* drive is specified, power production can often be greatly simplified. Maintenance may be reduced. Over-all station economy, too, may be improved by taking full advantage of the mechanical-drive turbine's double dividend of heat and power. The now-better-than-ever Type D turbine has a strainer to prevent entrance of foreign materials, a combined trip and throttle valve to assure protection against overspeed, and ring-lubricated bearings with the oil supply insulated and cooled by circulating water. With these exclusive features, no wonder Type D's are finding their way into so many of the most efficient power plants in America.

If you are interested in heat balance, find out what Type D turbines can save by doing double duty—acting as reducing valves to provide clean, low-pressure steam for feed water heating and providing low-cost mechanical power for auxiliary drive.

Or, if you are primarily interested in protecting your plant against shutdowns, find out about the static and dynamic balancing of the rotor that minimizes wear on bearings and couplings, the chrome alloy buckets that resist corrosion and erosion, and the combined trip and throttle valve that can be reset in less than 10 seconds.

A G-E turbine specialist will gladly explain further the benefits of these features. Call him in today. You'll save time and money by following his practical recommendations. General Electric Company, Schenectady, N. Y.



A MEMO FOR THE YEAR 1 A.V.*

We must acknowledge the fact that during the present emergency it is difficult, if not impossible, to obtain equipment and supplies for any but defense projects. However, the present situation will not last, and far-sighted plant managers and engineers are already planning for "The Year 1 A.V.*"

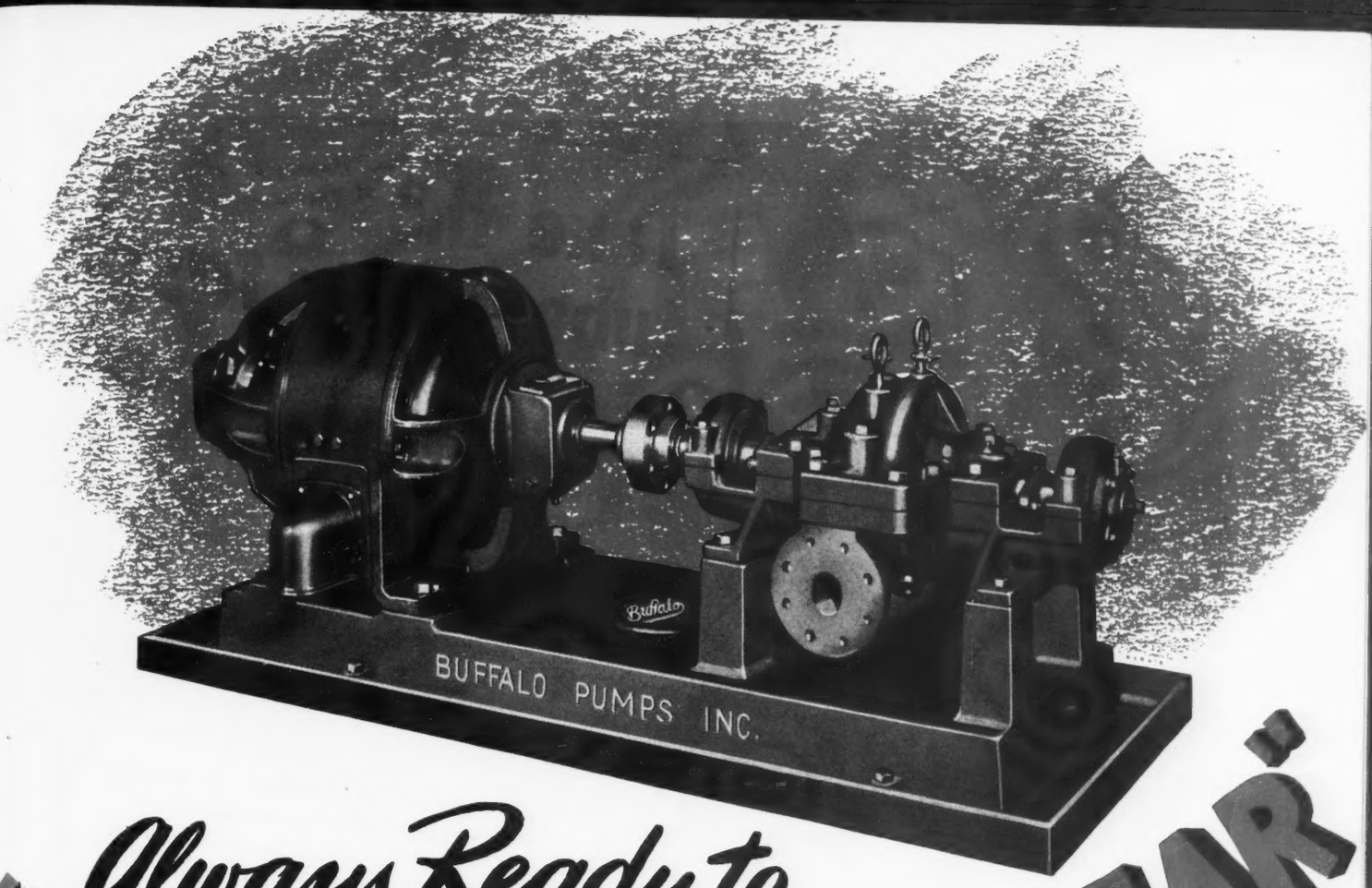
What do these plans include? Necessary replacements of equipment that is now being worn out at a rapid rate . . . readjustments to take care of regular commercial business that is now being subordinated to defense requirements . . . expansions that may be required for new developments.

"In time of war, prepare for peace" . . . and those who plan now will be in the best position for necessary readjustments without loss of time. Kennedy can help you decide on the most suitable types of valves for any projected requirements of service, fluid, pressure and temperature. The authoritative advice of the Kennedy engineers is yours without charge or obligation. Why not start now to prepare for "The Year 1 A.V.*"

***"The Year 1 A.V."? To American industry it means "AFTER VICTORY"*

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

KENNEDY *valves . . . pipe fittings . . . fire hydrants*



Always Ready to
"SWING into HIGH GEAR"

AND STAY THERE!

★ Buffalo Pumps are known as "brutes for punishment." This well-earned reputation is based on years of pump-building experience, quality materials and skillful workmanship. Buffalo Pumps run smoothly, with a minimum of wear-producing vibration . . . power input is low . . . efficiency high. There's a Buffalo Pump engineered to fit practically every industrial application.

BUFFALO PUMPS, INC.

488 BROADWAY **BUFFALO, N. Y.**

Branch Engineering Offices in Principal Cities

Canada Pumps, Ltd., Kitchener, Ontario

"Buffalo" PUMPS ★ ★

Take those tube curves *fast!*

Make an Elliott-Lagonda job of cleaning your curved tubes — that means a speedy job, and thorough too. There's a lot more to cleaning those short-radius curved tubes than just getting around the bends — you have to clean 'em too, at the same time! You have to use a cleaner that cannot only squirm its way through bend after bend, but that can put the "bite" on the toughest scale while doing it.

It takes an Elliott-Lagonda to do this double-barreled job, and it has taken a good many years of knowing how, to make the cleaner that will do it fast and well. Those years are working for you, when you use an Elliott-Lagonda.

There is plenty of experience on tap for you at "Tube Cleaning Headquarters." When the going gets tough, check with us. We can probably help. Write.

ELLIOTT COMPANY

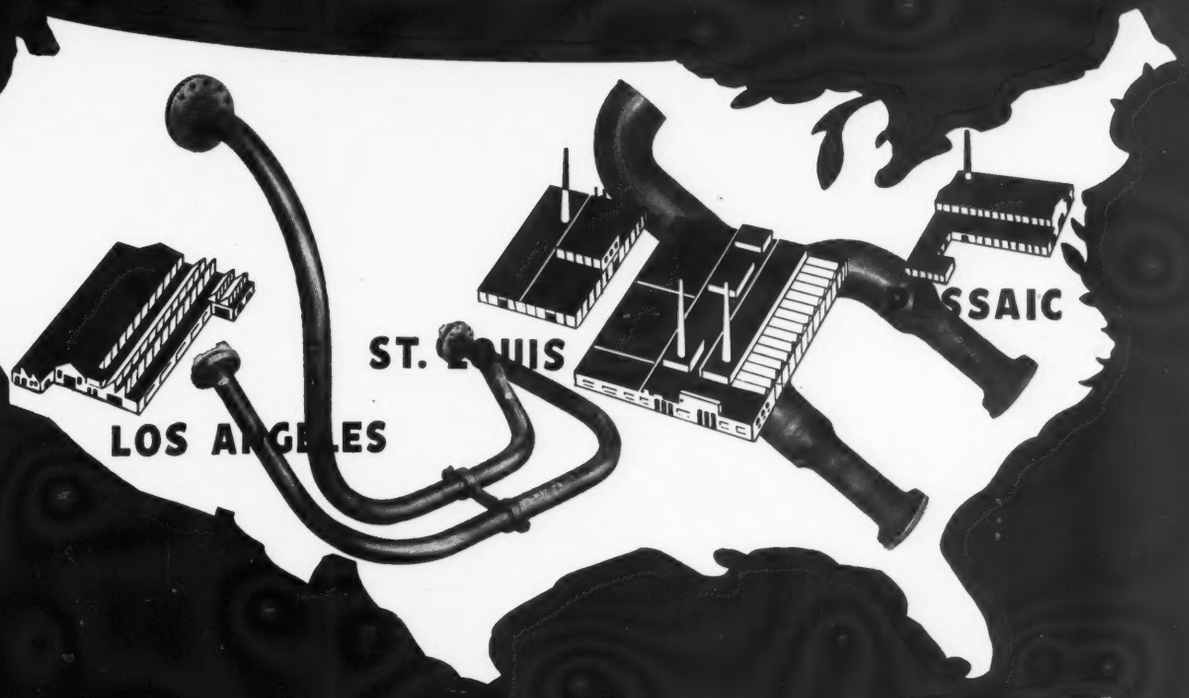
LAGONDA-LIBERTY Tube Cleaner Dept.

SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

Y-180

MIDWEST
PIPING SERVICE IS NATION-WIDE

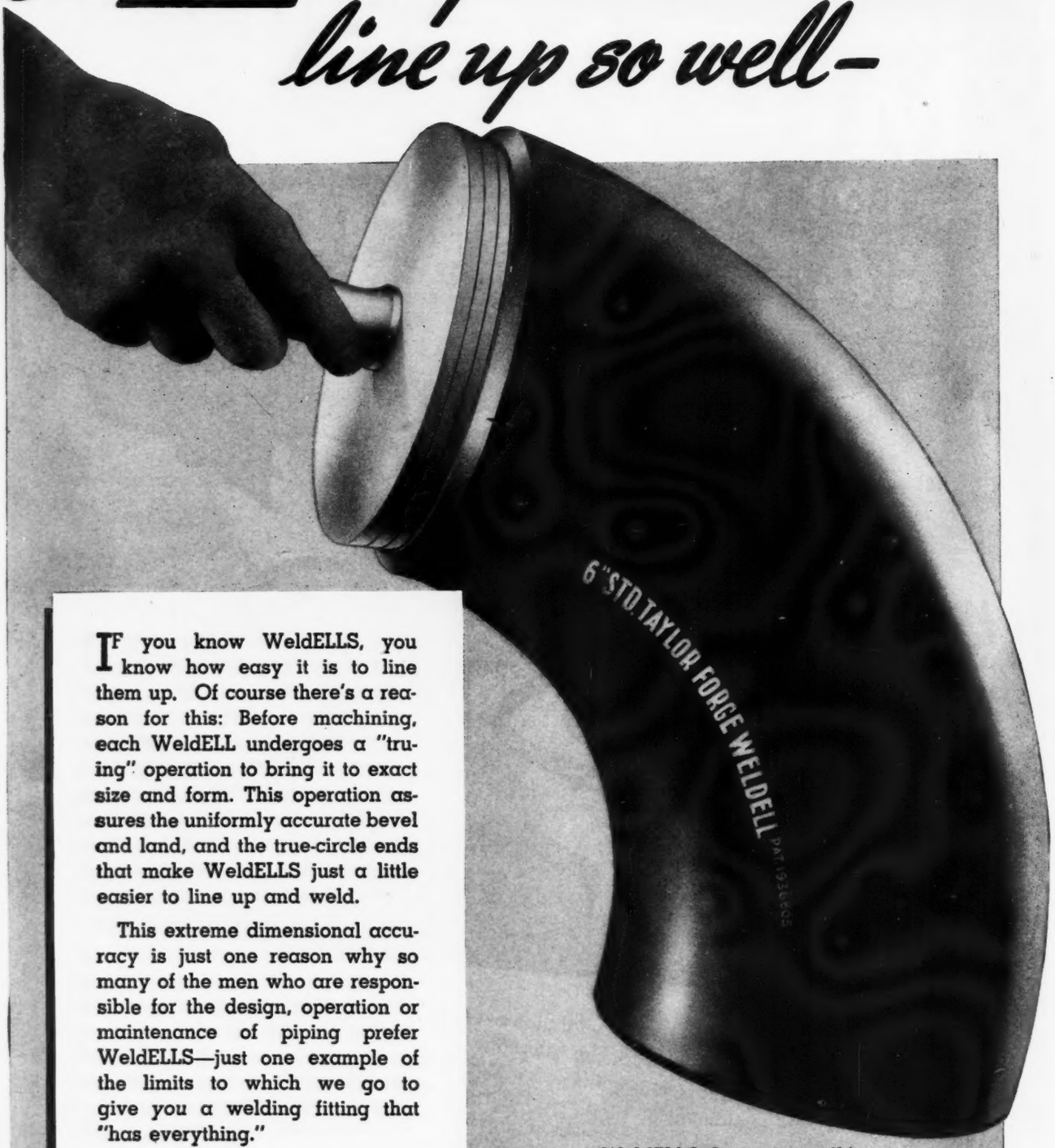


Now . . . that Time is more vital than ever before . . . the strategic locations of the Midwest plants for the fabrication of piping take on added importance. Each Midwest plant is a complete unit . . . provided with the most modern equipment and manned by a highly skilled organization for prefabricating all kinds of power plant and process piping. You will find it definitely advantageous to get in touch with the nearest Midwest office whenever you need fabricated piping . . . whether only a simple pipe bend, a coil or a complete alloy piping job.

MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 So. Second St., St. Louis, Mo. • Plants: St. Louis, Passaic (N. J.) and Los Angeles
Sales Offices: Chicago—949 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • San Francisco—436 Call Bldg. • Tulsa—533 Mayo Bldg.

So THAT'S why WeldELLS line up so well—



IF you know WeldELLS, you know how easy it is to line them up. Of course there's a reason for this: Before machining, each WeldELL undergoes a "truing" operation to bring it to exact size and form. This operation assures the uniformly accurate bevel and land, and the true-circle ends that make WeldELLS just a little easier to line up and weld.

This extreme dimensional accuracy is just one reason why so many of the men who are responsible for the design, operation or maintenance of piping prefer WeldELLS—just one example of the limits to which we go to give you a welding fitting that "has everything."

A number of other features are listed opposite — extra-value features that are combined only in WeldELLS.

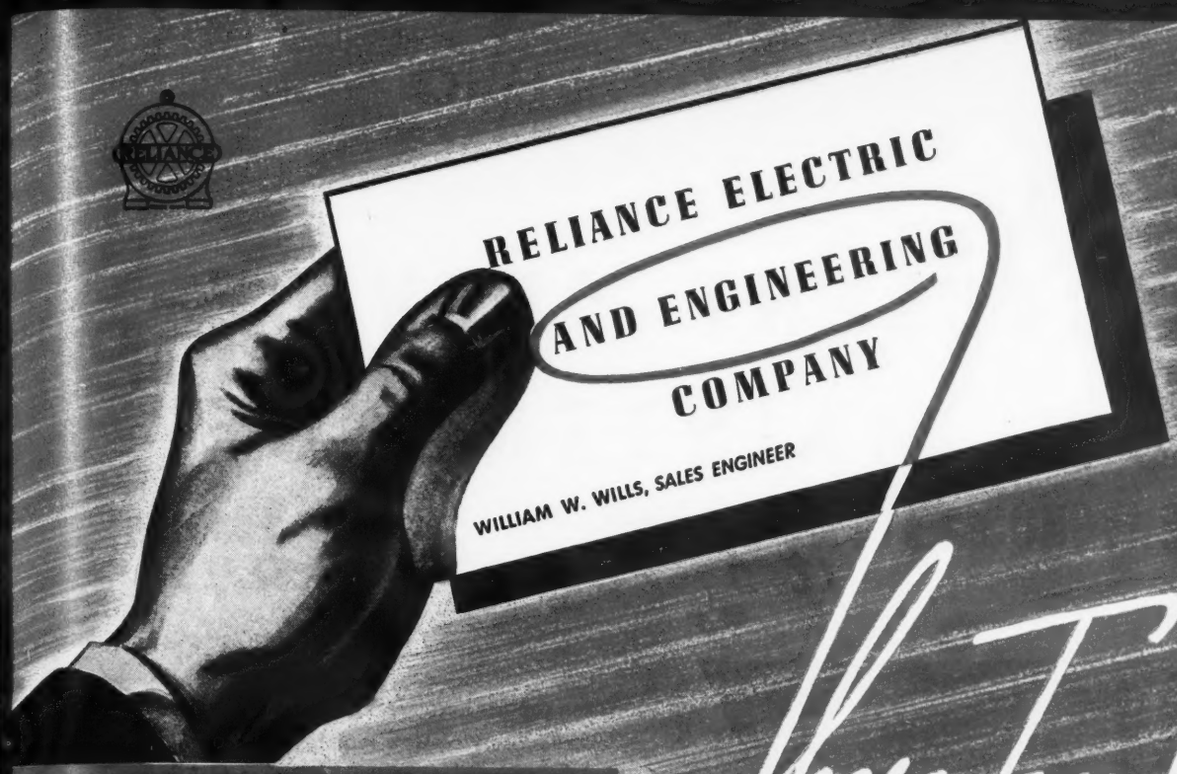
TAYLOR FORGE & PIPE WORKS

General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street
Philadelphia Office: Broad Street Station Bldg.

WeldELLS have everything

In addition to the features described opposite, WeldELLS have the following advantages which are combined in no other welding fitting:

1. **Seamless**—greater strength and uniformity.
2. **Tangents**—keep weld away from zone of highest stress—simplify lining up.
3. **Precision quarter-marked ends**—simplify layout and help insure accuracy.
4. **Selective reinforcement**—Provides uniform strength.
5. **Permanent and complete identification marking**—saves time and errors in shop and field.
6. **Wall thickness never less than specification minimum** — assures full strength and long life.
7. **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
8. **The most complete line of Welding Fittings and Forged Steel Flanges in the world**—insures complete and undivided responsibility.



These Two Words

MAKE *MOTOR-DRIVE* *MORE THAN* POWER!

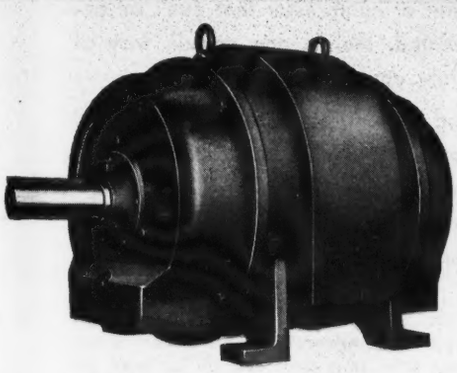
Motor-drive provides within itself a means of:

Speed Control	Reversing
Braking	Remote Control
Tandem Operation	Controlled Acceleration
Tension Control	Safety

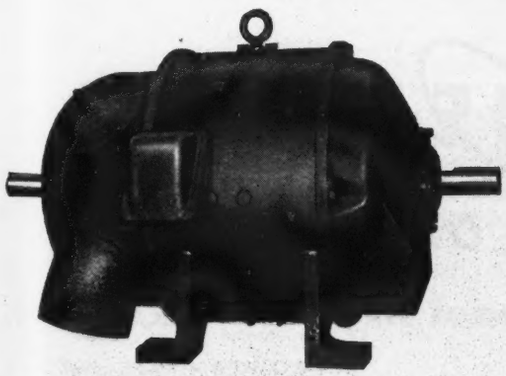
Slow Speeds for inching, threading, inspection

Applying them to boost production and improve quality is APPLICATION ENGINEERING. That's our business.

The man who sends this Reliance card to you is skilled in Application Engineering. He is prepared to discuss motor-drive as a means for boosting production and improving the quality of the products made in your plant. He represents an organization whose "bread and butter" for 35 years has come from showing industry how electric motors can be used profitably to do *many things* besides turn shafts and gears. To get the most from these production aids call in a Reliance man when your plans are in the early stages. He can help make motor-drive an integral part of your production equipment and not an appendage. No obligation, of course.



Splash-proof Type AA Squirrel-cage A-c. Induction Motor with ball bearings.



Splash-proof Type T D-c. Reliance Motor with ball bearings.

RELIANCE ELECTRIC & ENGINEERING CO.
1088 Ivanhoe Road • • • Cleveland, Ohio

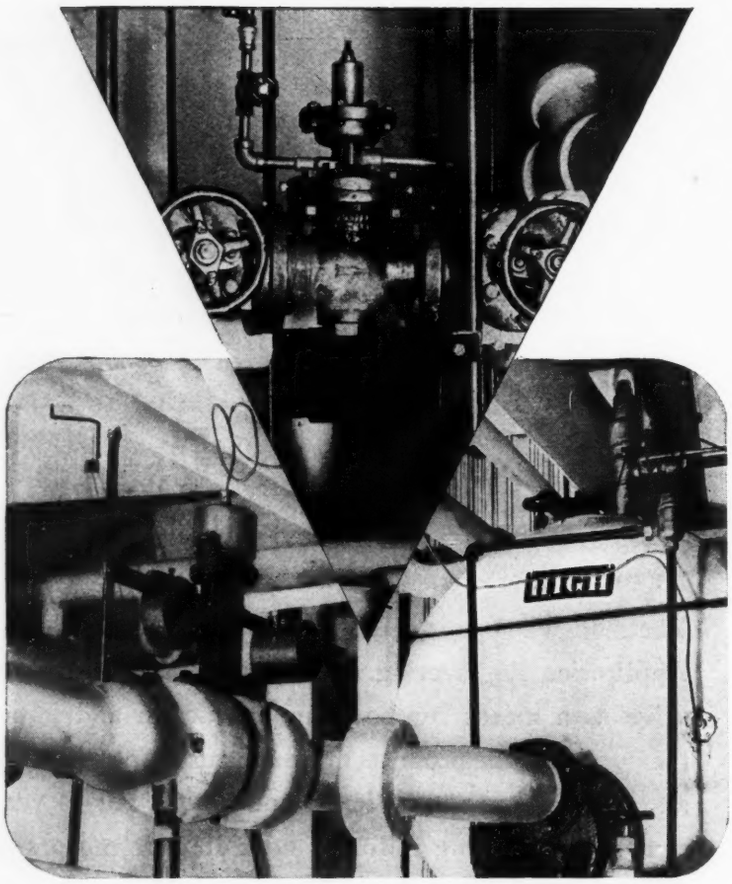
BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE, S. C. HOUSTON, TEX. • LOS ANGELES • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH PORTLAND, ORE. • ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. • and other Principal Cities

RELIANCE A-C D-C MOTORS

When it's

"EXCELLENT SERVICE—LOW MAINTENANCE"

it's Foster-again!



The upper illustration shows one of four Foster Type 37-G21 Pressure Reducing Regulators with low pressure tops in service in this bank building. This regulator reduces boiler pressure to 5-10 pounds for the Foster Type 39-T3 Temperature Regulator (shown in the lower illustration) which maintains a constant temperature of 140 degrees Fahrenheit in the storage heater supplying the hot water lines.

When reports from users of automatic valves read "excellent service—low maintenance," it's 10 to 1 that the name-plate on those valves reads "Foster."

Here's one from a chief engineer* of the company operating the power plant of one of the largest bank buildings in Metropolitan New York.

> "The service given by our twenty Foster Automatic Valves has been excellent. Maintenance has been very low; no major repair jobs have been necessary. In fact, the only maintenance necessary has been the normal expected replacement of a few springs and diaphragms."

If you have a regulating problem that hasn't been licked—pressure or temperature control, or a pump, blower or compressor that can't be accurately regulated, there's one certain way of getting the right answer—the first time.

Simply send your problem to Foster. We'll study your conditions and submit a specification, not on a valve once sold for a "similar service," but on one that will meet your every requirement, effectively and economically.

*Name on request.

Have you a copy of our new catalog? Its content is not limited to a mere sales story—such sections as those on application, operation, installation make it a handbook on automatic valves. A copy will be sent to executives and engineers in those industries serving national defense if the request is written on their companies' letterheads.

FOSTER ENGINEERING *Company*

PRESSURE REGULATORS • RELIEF AND BACK PRESSURE VALVES • AUTOMATIC STOP AND CHECK VALVES • ALTITUDE VALVES • DAMPER REGULATORS • FAN ENGINE REGULATORS PUMP GOVERNORS • TEMPERATURE REGULATORS • LIQUID LEVEL CONTROLLERS • FLOAT AND LEVER BALANCED VALVES • NON-RETURN AND TRIPLE DUTY VALVES • VACUUM REGULATORS OR BREAKERS • SIGHT FLOW BOXES • SIRENS • SAFETY VALVES

106 MONROE STREET • NEWARK, N. J.

3-FE-1

TURNING THE SPOTLIGHT ON ARSENIC

REVERE POINTS THE WAY TO BETTER CONDENSER TUBES

● A few hundredths of one per cent of arsenic introduced into Revere Admiralty condenser tube alloy has proved effective in preventing dezincification. This effectiveness has been demonstrated by Revere Arsenical Admiralty tubes in commercial installations. It is borne out by British practice. And it has now been verified further by a new series of laboratory tests described in a paper presented before a recent meeting of the American Society for Testing Materials.

Not only do these tests confirm that the addition of as little as 0.03% arsenic supresses dezincification of alpha brass alloys such as Admiralty metal—but they show that it does so without impairment of the alloy in other essential respects.

The author, Mr. W. Lynes, Research Metallurgist in the Revere Laboratories, states his conclusions as follows:

"Laboratory tests indicate that dezincification of alpha brass alloys may be effectively suppressed by a small addition (for example, 0.03 per cent) of arsenic, antimony or phosphorus, without impairment of the alloys in other respects. These results have been confirmed, especially in the case of arsenic, by extensive service experience."

This paper has been considered of such value that it was reprinted in full, without solicitation, by "Metal Industry", one of the leading British technical magazines. The general subject of condenser tube corrosion is of such vital and universal interest that Revere has reprinted the paper so that every engineer can be fully informed on the latest advances in condenser tube alloys.

Send for your free copy now. In it you will see why all Revere Admiralty condenser tubes are of the arsenical type. The Revere Technical Advisors are always ready to help you with your problems. Write us today.

WRITE FOR YOUR FREE COPY OF THIS PAPER

reprinted from the
Proceedings of the A. S. T. M.

REVERE

COPPER AND BRASS INCORPORATED

● *Executive Offices:* 230 Park Avenue, New York

MILLS: BALTIMORE, MD. · TAUNTON, MASS. · NEW BEDFORD, MASS. · ROME, N.Y. · DETROIT, MICH. · CHICAGO, ILL.

LUBRIPLATE lubricants are manufactured in various fluid and non-fluid densities to meet every condition and are packed in containers from one to five hundred pounds.

HERE'S THE LUBRICANT THAT'S MEETING TODAY'S URGENT NEEDS

That may sound like a bold statement—but it is being proved daily by thousands of users in every industry. LUBRIPLATE lubricants reduce friction and wear, save power and greatly prolong the life expectancy of plain and anti-friction bearings, gears, chains and other machine parts regardless of how tough the operating conditions may be. LUBRIPLATE is different from conventional lubricants—and is not only superior for modern machinery—but it enables old production machines to be stepped up to today's requirements. In these days of extreme emergency when machines are run at top speeds, and when replacement parts are hard to get—*LUBRIPLATE IS AN ESSENTIAL.* Write today for your copy of "THE LUBRIPLATE FILM" describing the use of LUBRIPLATE in GENERAL INDUSTRY.

LUBRIPLATE DIVISION
FISKE BROTHERS REFINING COMPANY
SINCE 1870
Newark, N. J. Toledo, Ohio
DEALERS FROM COAST TO COAST

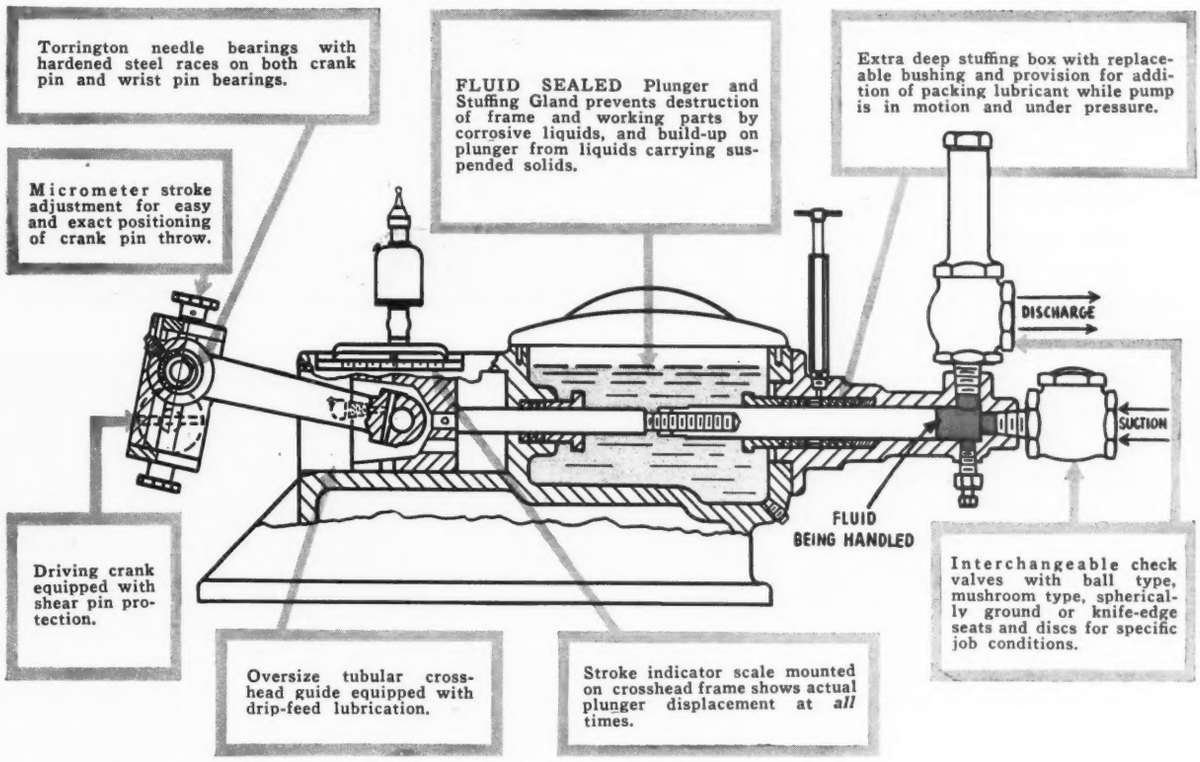
LUBRIPLATE

THE MODERN LUBRICANT *that Arrests Progressive wear*

"Its the Film"

For greater protection in feeding boiler water conditioning chemicals %Proportioneers, Inc. % offer the NEW Adjust-O-Feeder —FLUID SEALED against corrosion and plunger build-up.

Only ADJUST-O-FEEDER gives you *all* of these important design features:


Torrington needle bearings with hardened steel races on both crank pin and wrist pin bearings.
FLUID SEALED Plunger and Stuffing Gland prevents destruction of frame and working parts by corrosive liquids, and build-up on plunger from liquids carrying suspended solids.
Extra deep stuffing box with replaceable bushing and provision for addition of packing lubricant while pump is in motion and under pressure.
Micrometer stroke adjustment for easy and exact positioning of crank pin throw.
DISCHARGE
SUCTION
FLUID BEING HANDLED
Driving crank equipped with shear pin protection.
Interchangeable check valves with ball type, mushroom type, spherically ground or knife-edge seats and discs for specific job conditions.
Oversize tubular crosshead guide equipped with drip-feed lubrication.
Stroke indicator scale mounted on crosshead frame shows actual plunger displacement at *all* times.

Constant Rate, Duplex Adjust-O-Feeder

% Proportioneers, Inc. % has a size and type feeder for every high or low pressure chemical feeding job.

% Proportioneers, Inc. % now offer the FLUID SEALED Plunger and Stuffing Gland in all the devices comprising their complete line for Constant Rate and Flow Proportional Treating and Blending.

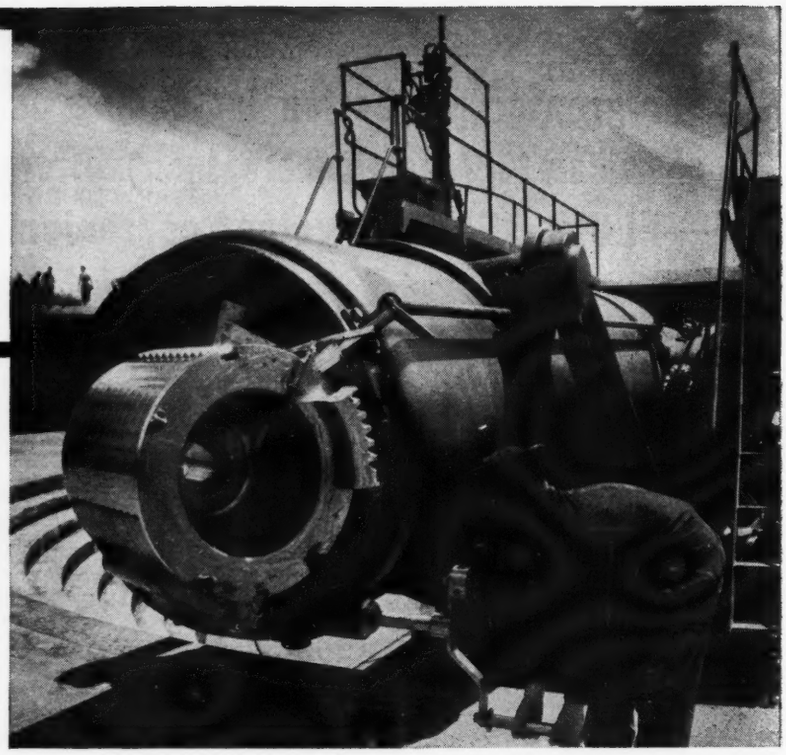
Write today for recommendations on your boiler water conditioning problems—no obligation.

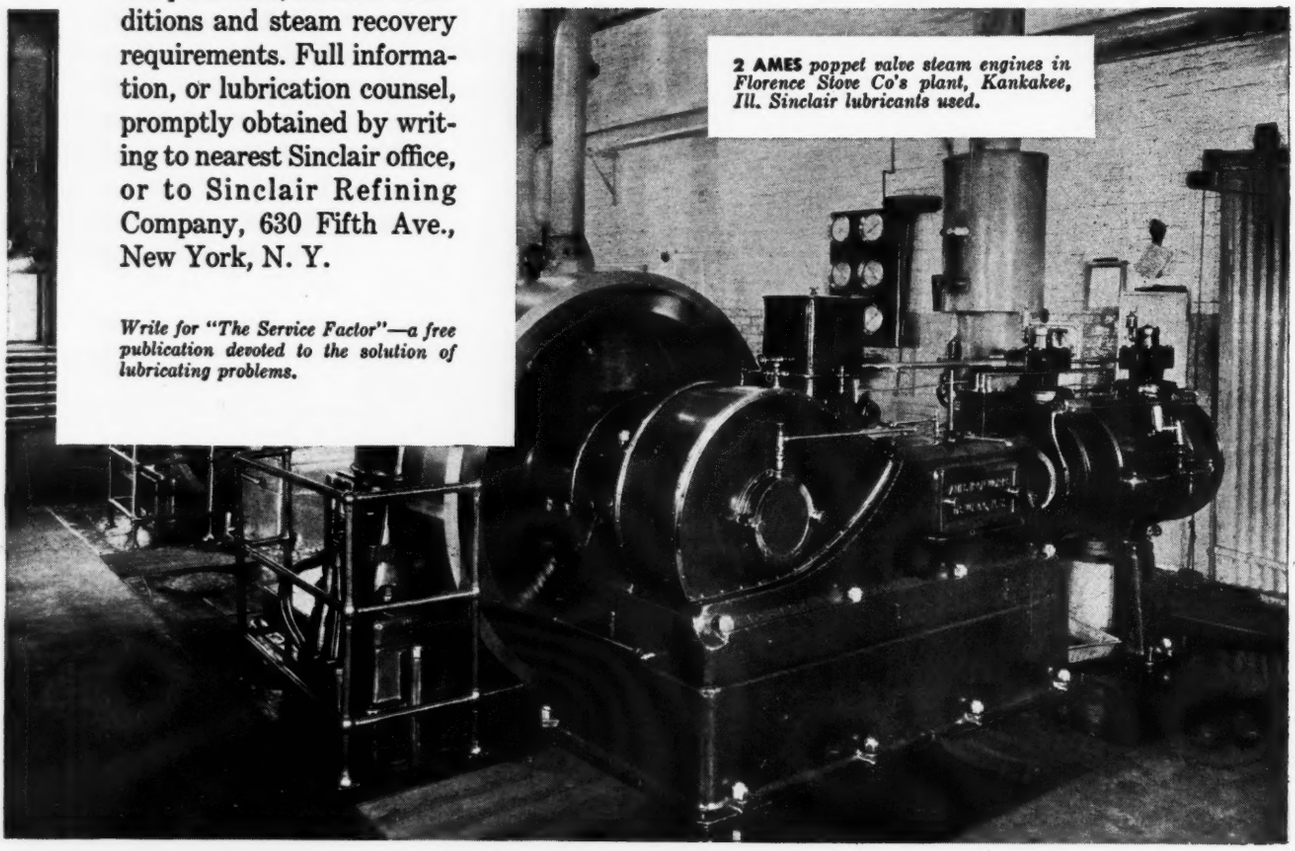
%PROPORTIONEERS, Inc.% 16 CODDING ST., PROVIDENCE, R. I.

WAR SPEED-UP cannot be *safely* maintained with inadequate lubrication. For the *safe* lubrication of *STEAM ENGINES* there are . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS supported by a long record of perfect performance in heavily loaded installations. No matter how difficult the operating conditions may be, there are Sinclair oils exactly suited to your plant's pressures, temperatures, moisture conditions and steam recovery requirements. Full information, or lubrication counsel, promptly obtained by writing to nearest Sinclair office, or to Sinclair Refining Company, 630 Fifth Ave., New York, N. Y.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.





2 AMES *poppet valve steam engines in Florence Stove Co's plant, Kankakee, Ill. Sinclair lubricants used.*

SINCLAIR INDUSTRIAL OILS

SINCLAIR REFINING COMPANY (Inc.)

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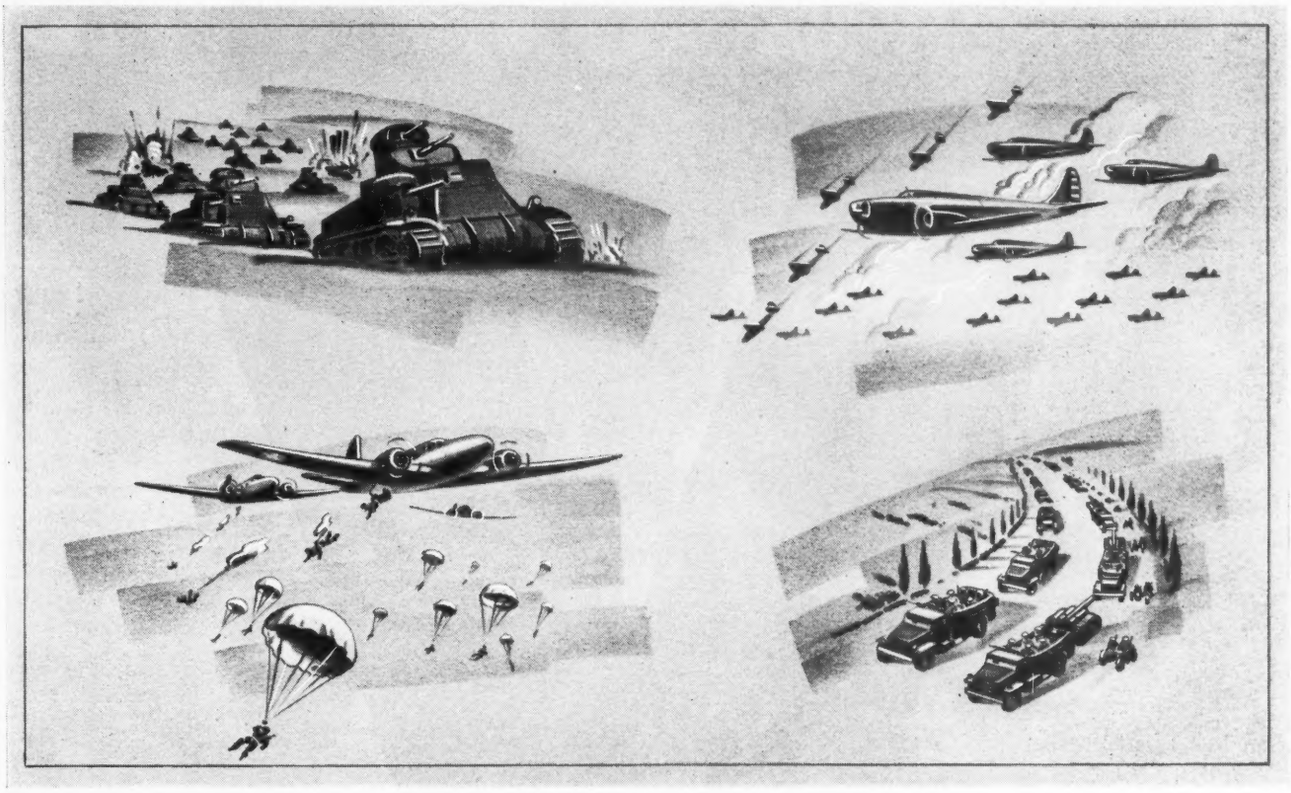
A Pre-Fabricated Army

Is Essential to MILITARY SUCCESS



An army cannot be trained as an army. It must be developed as a series of smaller units: infantry, artillery, aviation, mechanized equipment, paratroops, etc. These *sub-assemblies* are built up separately . . . then assembled by carefully pre-arranged plans and co-ordinated into a modern army. The most successful military machines are built in this way.

Pre-fabricated Piping works that way too. It is delivered in a series of sub-assemblies, each made to fit exactly into the total plan. Each is shop-tested, accurately aligned, pre-heated and stress-relieved when necessary, thoroughly cleaned, ready. When assembled in the field according to plan, the sub-assemblies go together with remarkable ease, and the system is ready for operation far sooner than could be accomplished by any other method. All difficult welding is done in well-equipped shops where special machinery is available to speed it and assure its quality. Field work is reduced to simplest operations.

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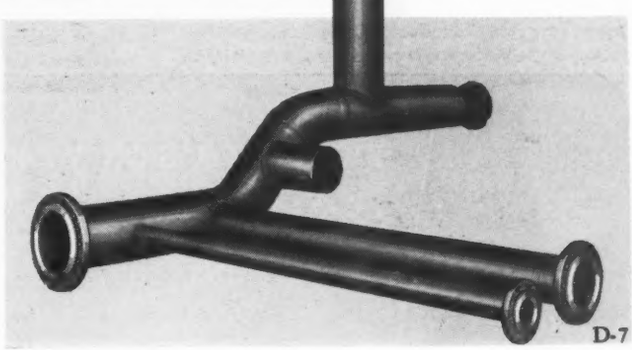
P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING • PITTSBURGH, PA.

Pre-Fabricated Piping OFFERS SIMILAR ADVANTAGES



D-7

U. S. QUARTERMASTER DEPOT
4-units each 110,000 # of steam per hour. 275 # pressure. 3-drum Bent Tube Steam Generators with Superheaters, Air Preheaters, Water Walls and Oil Burners.
U. S. NAVAL AIR STATION
3-units each 24,000 # of steam per hour. 160 # pressure, saturated temperature, 4-drum Bent Tube Steam Generators with Air Cooled Walls and fired with oil and gas.
U. S. CHEMICAL WARFARE SERVICE
2-units each 32,000 # of steam per hour. 200 # pressure, saturated temperature, 3-drum Bent Tube Steam Generators with Water Walls and Oil Burners.

The contract for each of these installations calls for the furnishing of equipment, complete erection and putting into operation by EDGE MOOR.

EDGE MOOR IRON WORKS, INC. 30 Rockefeller Plaza.
New York, N. Y.

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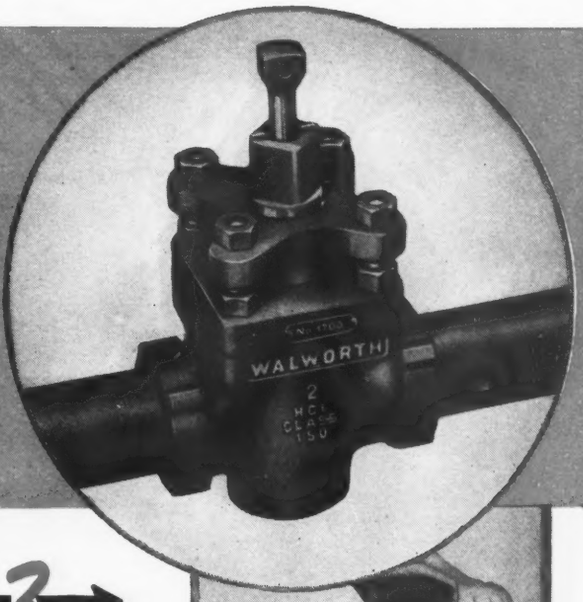
In Canada UNITED STEEL CORPORATION, LTD. Toronto Montreal

MAKE THEM LAST LONGER!

LUBRICATE AT REGULAR INTERVALS...

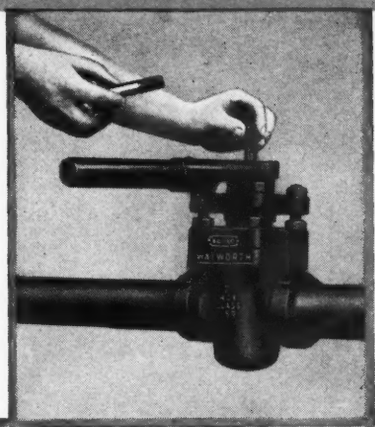
1

The conservation of metal is vital. It is essential that your valves are kept in good working condition as long as possible. A few minutes care at *regular* intervals will mean a longer useful life to your Walworth Lubricated Plug Valves. Check your valves more frequently and provide additional lubricant when necessary.



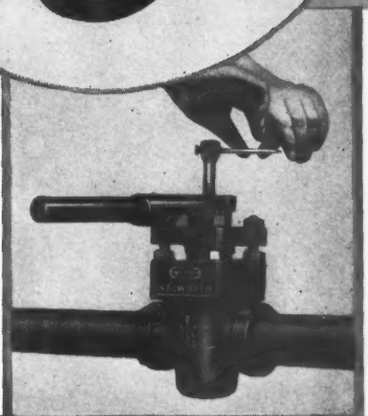
2

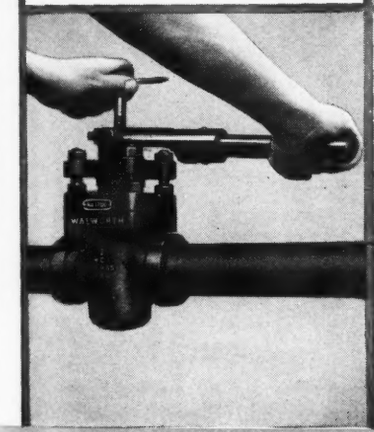
To renew the lubricant in the Walworth Lubricated Plug Valve, remove the lubricant screw. Then place a stick of lubricant in the lubricant chamber. Note:—The service determines the lubricant to be used.



3

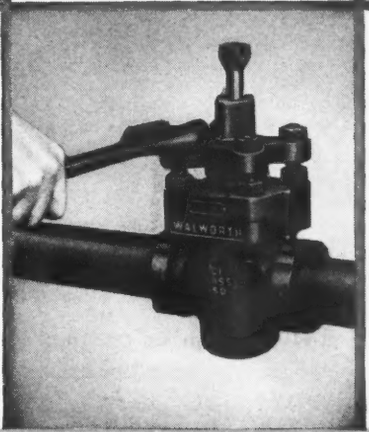
Replace the lubricant screw and tighten it until a back pressure is felt. Add lubricant if system is not completely filled.





4

The plug should be moved back and forth slightly while lubricating the valve.



5

If the plug moves too freely the gland nuts should be screwed down evenly to keep the plug seated and prevent loss of lubricant into the pipeline. Never loosen gland nuts without first lubricating the valve.

THIS IS OUR CENTENNIAL YEAR

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH. ANNIVERSARY

This year marks the 100th Anniversary of the founding of our company, and we had a nice series of "institutional" ads in mind to tell you about it. We hope you saw the first one, which appeared in the January trade publications. Needless to say, that ad was prepared before December 7, 1941, and things have happened since then.

Advertising is conceded to be the most economical means of telling a message to the greatest number of people, and in this period of Priority Production we feel that it is the duty of Walworth advertising to cooperate in a national program of Salvage, Simplification, Specification, and Substitution.

So we've scrapped the "institutional" ads we had planned for our centennial year, and present a series of ads which we think will help valve and fitting users get more service from their existing Walworth material and thereby permit the output of our five plants to be used to the best advantage for Victory in the great national effort.

WALWORTH

VALVES FITTINGS and TOOLS
Backed by 100 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

-To win America's Battle of PRODUCTION

PRODUCTION is now our number one job. Victory will go to the nation with the most machines and the power to run them.

In winning this war of production, CAREY HEAT Insulations are performing an important and essential part — conserving America's fuel resources—conserving manpower, machine-power, money-power . . . meeting the new strains and stresses of increased temperatures and pressures for higher and still higher power-production efficiency.

Now, at a time when the last ounce of power is urgently needed, it is essential that time tried methods and materials be used for the conservation of heat and fuel. CAREY Insulations have proved their outstanding performance in hundreds of power plants throughout the nation. They meet every service condition, from sub-zero to 2500°F. Whatever your insulation problem, make certain of correct and lasting results by specifying CAREY Insulations. A nation-wide organization is at your service. Write for details, address Dept. 16.

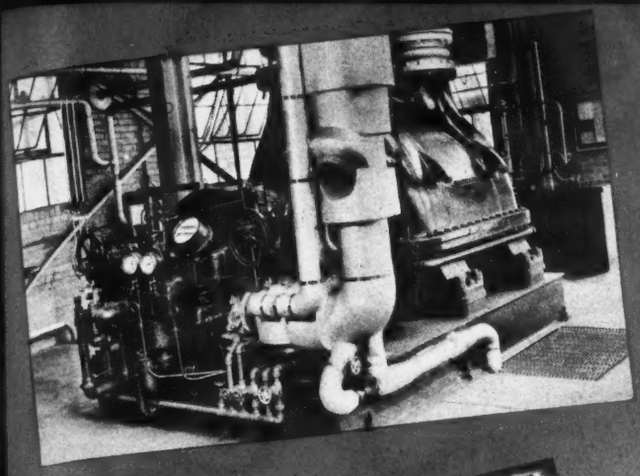
THE PHILIP CAREY MFG. COMPANY

Dependable Products Since 1873

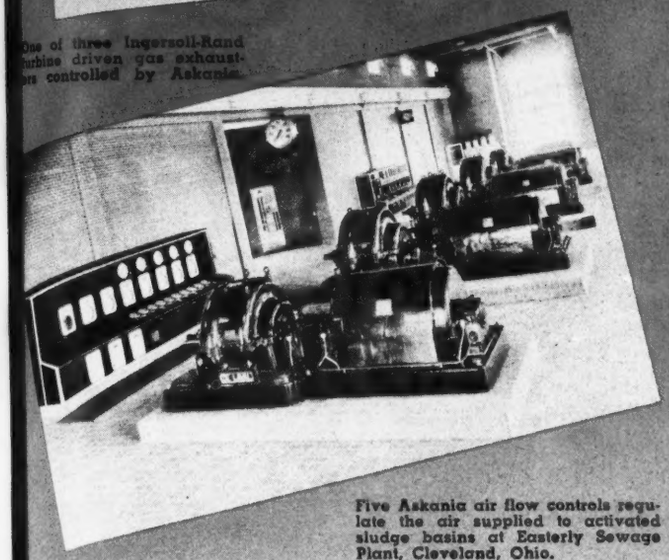
Lockland, Cincinnati, Ohio

In Canada: **The Philip Carey Company, Ltd.**
Office and Factory: **Lennoxville, P. Q.**

Carey HEAT INSULATIONS



One of three Ingersoll-Rand turbine driven gas exhaust-ers controlled by Askania.



Five Askania air flow controls regulate the air supplied to activated sludge basins at Easterly Sewage Plant, Cleveland, Ohio.

Protect your prime movers with ASKANIA CONTROL

MORE than ever now, you need control equipment that will not only give you accurate control, but complete protection of your investment. Askania control does this through the simple hydraulically operated jet pipe principle.

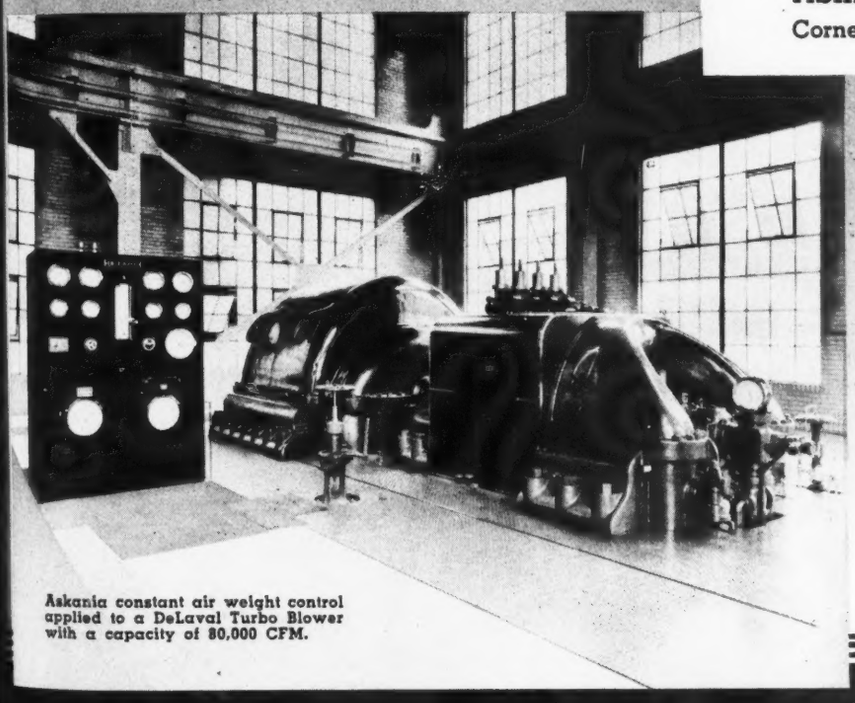
Here are a few of the many applications that have proved the value of that better operation that comes with Askania control.

- Turbine Bleeder Control
- Turbine Back Pressure Control
- Turbo-Blower Control
- Turbo-Exhauster Control
- Turbo-Booster Control
- Pressure, Flow and Suction Control for Parallel Operated Units
- Speed and Governor Control
- Volume and Pressure Control to Prevent Pumping

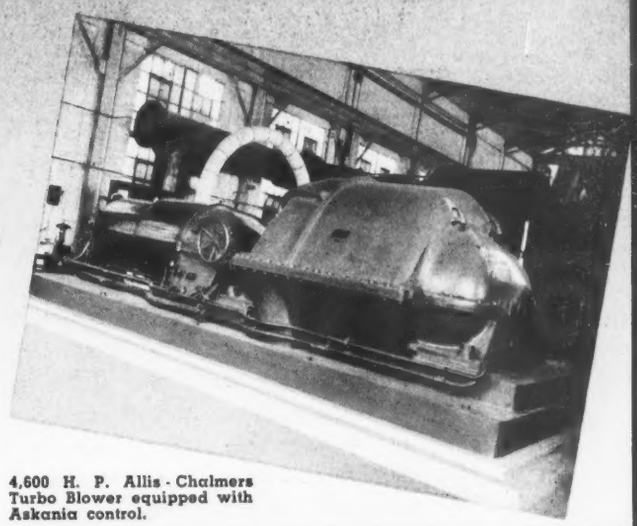
Only the best equipment has a place in America's War Industry, and when it comes to automatic control for Prime Movers, that means *ASKANIA*.

Write for information on any problem involving pressure, flow, proportioning or boiler combustion control.

ASKANIA REGULATOR COMPANY
Corner 16th and Michigan, Chicago, Illinois



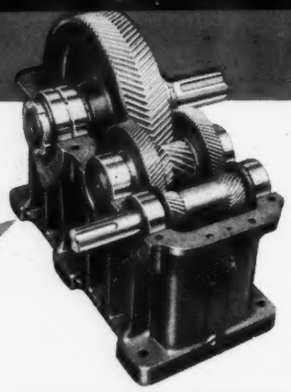
Askania constant air weight control applied to a DeLaval Turbo Blower with a capacity of 80,000 CFM.



4,600 H. P. Allis-Chalmers Turbo Blower equipped with Askania control.

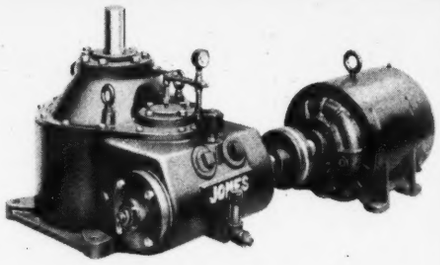
ASKANIA
REGULATOR CO. CHICAGO
AUTOMATIC CONTROL

To help you SPEED PRODUCTION



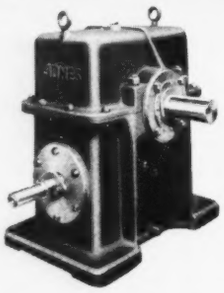
HERRINGBONE REDUCERS

Available in single, double and triple reduction types in a wide range of ratios and ratings.



WORM-HELICAL SPEED REDUCERS

A versatile line of double reduction units for agitators, mixers or other applications requiring a vertical shaft drive.

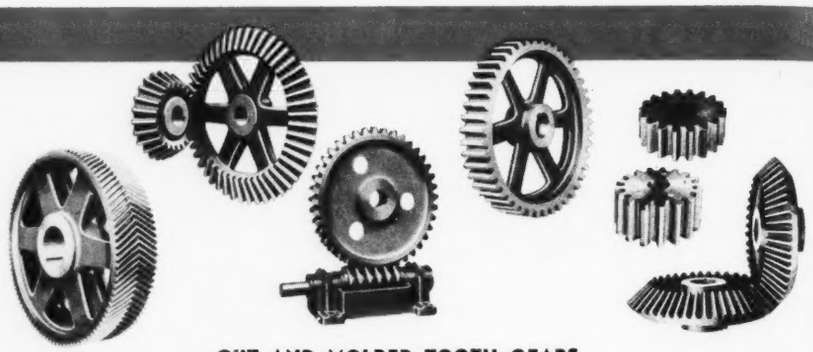


WORM GEAR REDUCERS

Built in light and heavy duty types and in various styles to suit the conditions.

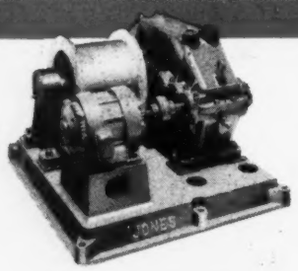
SPUR GEAR REDUCERS

Concentric straight line drive in single and double reduction units.



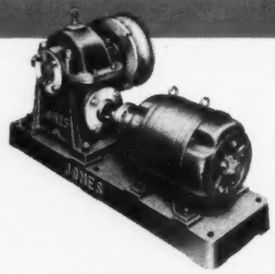
CUT AND MOLDED TOOTH GEARS

Jones gear cutting practice represents the accumulated technical knowledge of 50 years backed by the finest gear cutting equipment and craftsmanship.
The line covers cut tooth spur, helical, herringbone, worm, bevel, and mitre gears of high test cast iron, steel, bronze, or non-metallic material. An extensive line of patterns is also available for high test cast iron molded tooth, spur, bevel and mitre gears.



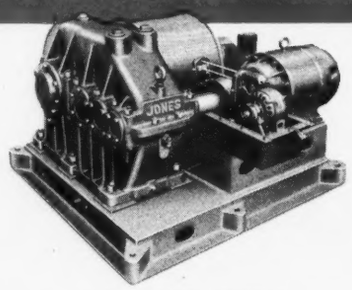
CAR PULLERS

These car pullers are built by Jones as complete units with motor included if desired, or with base to take purchaser's motor. The cable drum is driven by a Jones double or triple reduction Herringbone speed reducer and the control station may be located at a point to give the operator a clear view of the tracks and spotting positions.



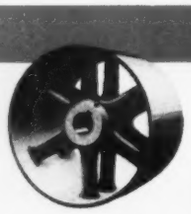
DOOR HOISTS

The Jones Door Hoist is a simple, compact and sturdy heavy duty worm gear driven unit that has been widely used in the steel industry for handling furnace doors. It is also applicable to other services where doors of various types must be opened and closed and where it is desired to avoid the complications of limit switches.



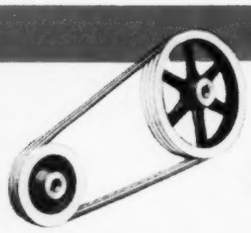
SKIP HOIST DRIVES

Jones Skip Hoist Drives are equipped with all the modern protective devices such as cam or nut type limit switches, solenoid or disc type brakes and slack cable switches. Drives are standard Jones Herringbone Speed Reducers.



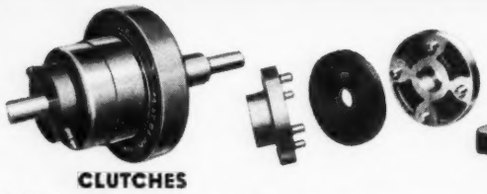
PULLEYS

Jones pulleys are machine molded, poured of high test cast iron, and are accurately finished and balanced. Single arm, double arm, multiple piece and extra heavy conveyor pulleys and flywheels can be supplied.



V-BELT SHEAVES

Made of high test cast iron. Sheaves for "AB" light duty combination and "C" belts in stock with keyseated bushings. Standard and special sheaves for all industrial belt sections made to order.

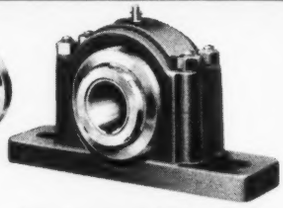


CLUTCHES

Built for a broad range of shaft sizes and ratings in both enclosed and open types for sleeve and coupling work. In addition they are available in a line of friction clutch pulleys. This clutch modification is also used with gears, V-belt sheaves or sprocket wheels.

COUPLINGS

High and low speed flexible couplings, flange, keyless compression, ribbed and jaw clutch couplings.



PILLOW BLOCKS

Jones Pillow Blocks have double row Timken Roller Bearings locked firmly to the shaft by means of a tapered split steel adaptor and clamp nut. Effective seal retains lubricant . . . easily removed from shaft.

HANGERS

Jones drop hangers, post hangers and bracket hangers are strongly reinforced with arch bracing. Free universal adjustment. Feet are ground.

Jones

W. A. JONES FOUNDRY & MACHINE COMPANY
4401 Roosevelt Road, Chicago, Illinois

BULLETIN No. 80

"Jones Drives for Industry" may be helpful in giving you a complete picture of the Jones products, engineering services and manufacturing facilities that are available. Your request will bring a copy.

LET'S PUT WINGS ON TOMORROW!

Today, Keasbey & Mattison Company is devoting all its energies to the war program. Material shortages and priority restrictions make it impossible for us to serve other than war orders.

But the future looks bright to us. For we've glanced ahead, through research, and when peace returns, new and improved asbestos products will contribute more than ever before to better living for everyone. It is *tomorrow* . . . not today . . . that will yield the benefits of this projected thinking.

Right now, total victory comes before everything else. There is no room for doubts, delays or complaints. Only *work* . . . hard, unflagging *work* . . . will bring us through the night.

Americans have what it takes; let's get the job done quickly and completely . . . the sooner to enjoy the things to come!

Let's put wings on Tomorrow!

★ ★ ★

Nature made asbestos; Keasbey & Mattison has made it serve mankind . . . since 1873.

KEASBEY & MATTISON

COMPANY, AMBLER, PENNSYLVANIA

K&M best in asbestos

FOR FULL

MOBILIZATION

OF POWER FACILITIES

1 Morse Roller Chains

2 Morse Silent Chains

3 Morse Indexing and Free-Wheeling Clutches

4 Morse Silent Chain Couplings

5 Morse Morflex Couplings

DEPEND ON

MORSE DRIVES

In these days of "all out" production, the job of efficient, dependable power transmission becomes extremely important. Power loss through inefficient drives can seriously effect your production schedules. Insure against production set-backs by transmitting all the power with Morse Drives. Regardless how large or small your drive requirements may be—Morse Drive equipment will meet your needs more efficiently and economically. Morse Silent and Roller Chains have many exclusive features. They deliver at 99.4% efficiency. Don't overlook the many advantages of Morse Silent Chain and Morflex Couplings. They are dependable, long lasting and have proven themselves worthy in hundreds of different installations under the most severe conditions. Morse Indexing and Free-Wheeling Clutch Couplings are ideal for indexing and free-wheeling purposes—available in many sizes. You will profit with Morse Drive equipment—consult the Morse man in your territory—today.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

He never stops trying to help you

CALL YOUR ELECTRUNITE DISTRIBUTOR FIRST

Give him a chance to help you solve your boiler tube problem. He's anxious to serve you—*and can in many ways.* He may not be able to give you *all* the tubes you would like to have, but he won't stop trying.

When you put your problem up to your ELECTRUNITE Distributor, he tackles it as if it were his own. For today, *your* worries are *his* problems, and his business depends on his solving them. So, he has rolled up his sleeves and buckled down to the job of using all his facilities overtime to give you emergency service *now* when you need it most.

He may be able to supply promptly enough tubes from stock to make needed repairs—perhaps, the tubes for a new boiler, if it is to be used for *Production for Victory.* If he can't, he'll go the limit to get them for you. He may be able to suggest ways to lengthen the life of your tubes. He just never lets up in his effort to help you.

And you can help him, too—by *always* giving complete data on your preference rating extension with *every order.* In this way you enable your distributor to replace material furnished you from stock—you make it possible for the manufacturer to secure raw material to make the additional products you will need in *Production for Victory.*

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
CLEVELAND • OHIO

Berger Manufacturing Division • Niles Steel Products Division
Union Drawn Steel Division • Culvert Division • Truscon Steel Company

Republic

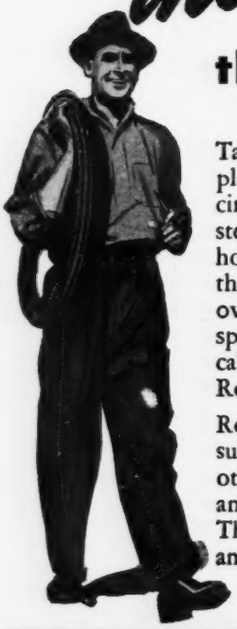
ELECTRUNITE

Reg. U. S. Pat. Off.

ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

Mop up the Hot Spots

with wire that won't bake out

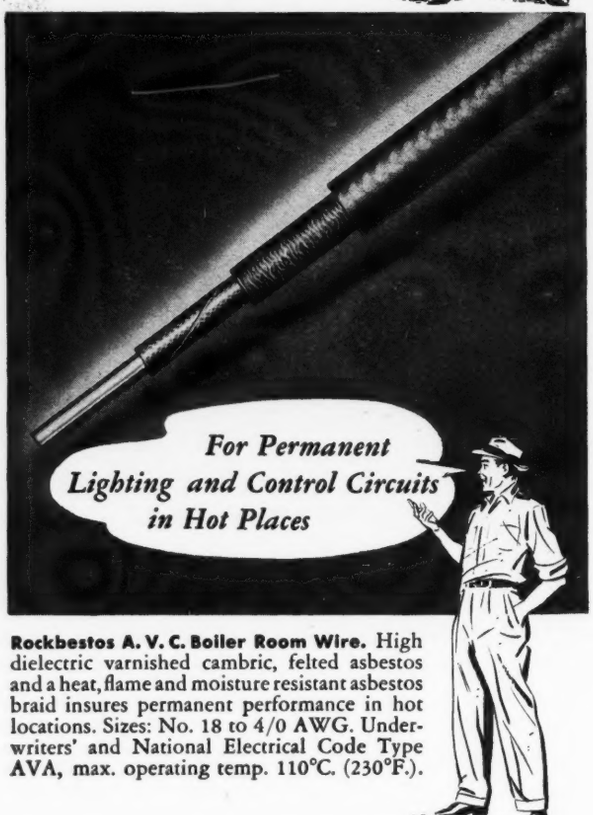


Take a trouble-shooting trip around your plant . . . check up on the power and lighting circuits that run around boilers, furnaces, steam lines, soaking pits, kilns, lehrs or other hot spots . . . and don't forget the motor leads that are taking more than their share of overload-heat, oil and grease. These are the spots where *trouble* starts—where wire and cable fail—spots where *permanently insulated* Rockbestos should be used.

Rockbestos wires, cables and cords are insulated to stand up in installations where other wires fail. They're not affected by heat and moisture, oil, grease or corrosive fumes. They can't burn. They mop up wire failures and prevent production interruptions.

Rockbestos A. V. C. Motor Lead Cable. Insulated with felted asbestos, heat-sealed varnished cambric and covered with an asbestos braid. Resistant to heat, flame, moisture, oil and grease. Sizes: No. 18 AWG to 1,000,000 CM. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

Rockbestos A. V. C. Power Cable. Laminated felted asbestos and varnished cambric insulation and a rugged asbestos braid withstands heat and condensation in boiler rooms, steam tunnels, etc. Sizes: No. 18 AWG to 1,000,000 CM. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).



Rockbestos A. V. C. Boiler Room Wire. High dielectric varnished cambric, felted asbestos and a heat, flame and moisture resistant asbestos braid insures permanent performance in hot locations. Sizes: No. 18 to 4/0 AWG. Underwriters' and National Electrical Code Type AVA, max. operating temp. 110°C. (230°F.).

Plan Now We can take care of defense industries. When ordering specify minimum footage requirements and send in preference rating papers. Samples and catalog on request.

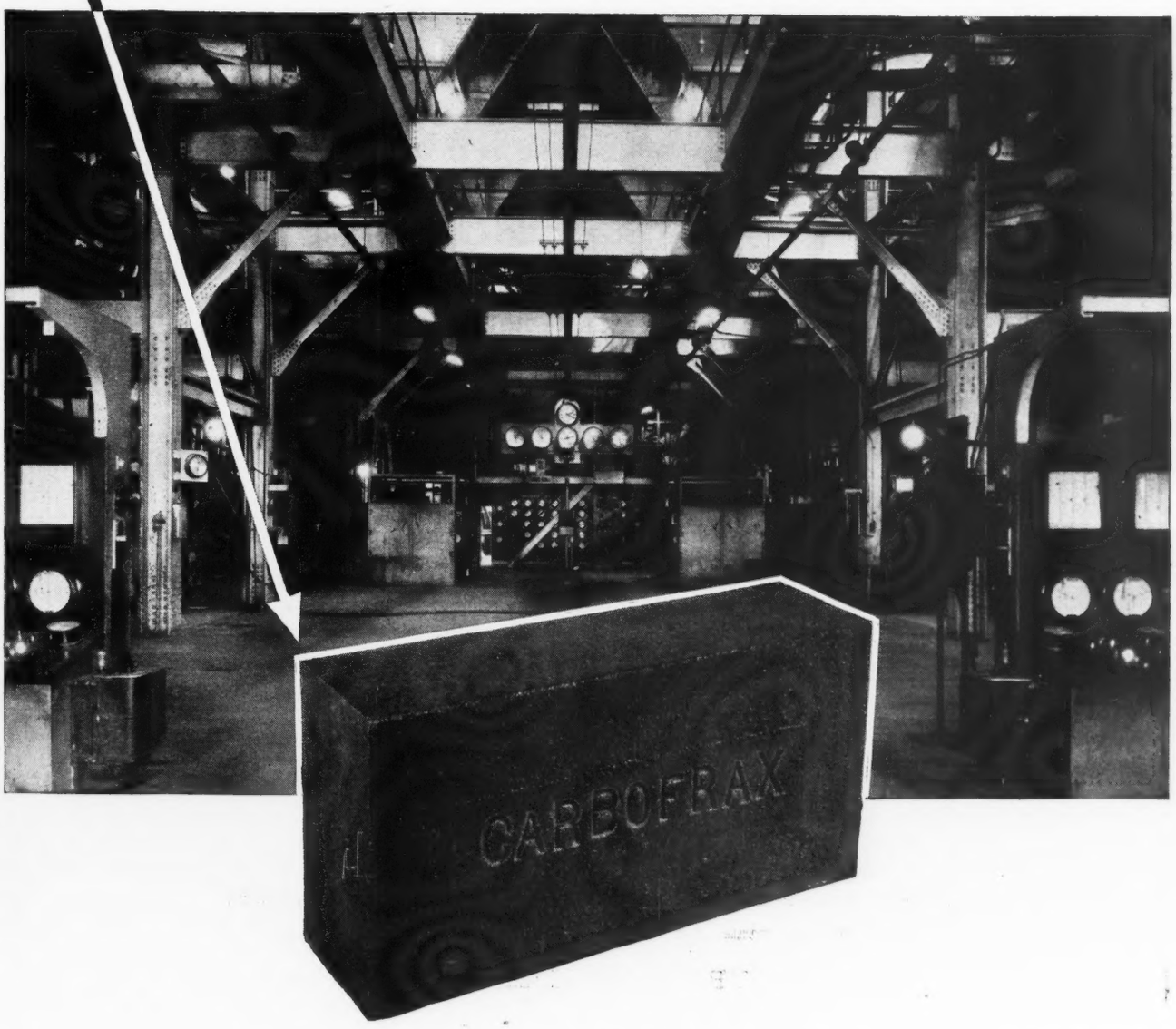
ROCKBESTOS PRODUCTS CORPORATION
839 Nicoll St., New Haven, Connecticut

ROCKBESTOS A.V.C.

THE WIRE WITH PERMANENT INSULATION

NEW YORK, BUFFALO, CLEVELAND, DETROIT, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

WHY USE "CARBOFRAX" IN YOUR BOILER FURNACES?



Remember a "Carbofrax" setting is a dependable setting.

REFRACTORY CARBORUNDUM PRODUCTS

THE CARBORUNDUM COMPANY

REG. U. S. PAT. OFF.

Refractory Division, **PERTH AMBOY, N. J.**

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

[Carborundum and Carbofrax are registered trade-marks of and indicate manufacture by The Carborundum Co.]

• An honest question deserves a straightforward reply.

Without the frills of a sales talk, the answer is: to insure continuity of operation—provide for increased capacity—improve boiler efficiency.

"Carbofrax" brick in your setting will do just these things because of their extremely high refractoriness—outstanding resistance to spalling—ability to eliminate clinker adhesion, with consequent improvement in combustion conditions.

Thousands of installations have proved the ability of "Carbofrax" brick to lower refractory costs, reduce maintenance expense and eliminate frequent outages for setting repairs. That is why you should use "Carbofrax" in your boiler furnaces.

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

29 years of research development and operating experience by the affiliated Cottrell Companies throughout the world is incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements of any problem by

RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

"WAR TIME"

Gains One Hour

FOR DEFENSE

POWER CONSUMPTION

PITTSBURGH PIPING *Saves Months*

IN NEW POWER CONSTRUCTION FOR DEFENSE

IN gaining one hour more of sunlight, National "War Time" provides a much needed shift in power consumption peak loads and frees more power for industry. When planning much-needed facilities for increased power generation, Pittsburgh Piping can save months from the blue print stage to actual operation by providing speedy, efficient fabrication and erection of complete piping systems.

Its strategic location in the district that produces the majority of seamless pipe reduces transportation time from the mills to the Pittsburgh Piping fabricating shops. Modern fabricating methods, on-the-spot facilities for bending, heat-treating, machining, testing, and insurance save many precious days—even months. Assemblies are fabricated in large sections, thus reducing field work to a minimum. Pittsburgh Piping's experienced and efficient construction department provides facilities for speedy erection in any part of the country.

Time is the most precious commodity in America today. Your nearest Pittsburgh Piping representative, listed below, can tell you in detail how you can save months in new power construction.

Pittsburgh Piping

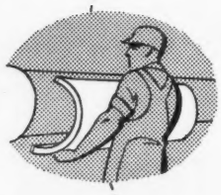
Fabrication—Engineering and Erection of Central Station, Industrial, and Process Piping

PITTSBURGH PIPING & EQUIPMENT CO., 10 FORTY-THIRD ST., PITTSBURGH, PA.

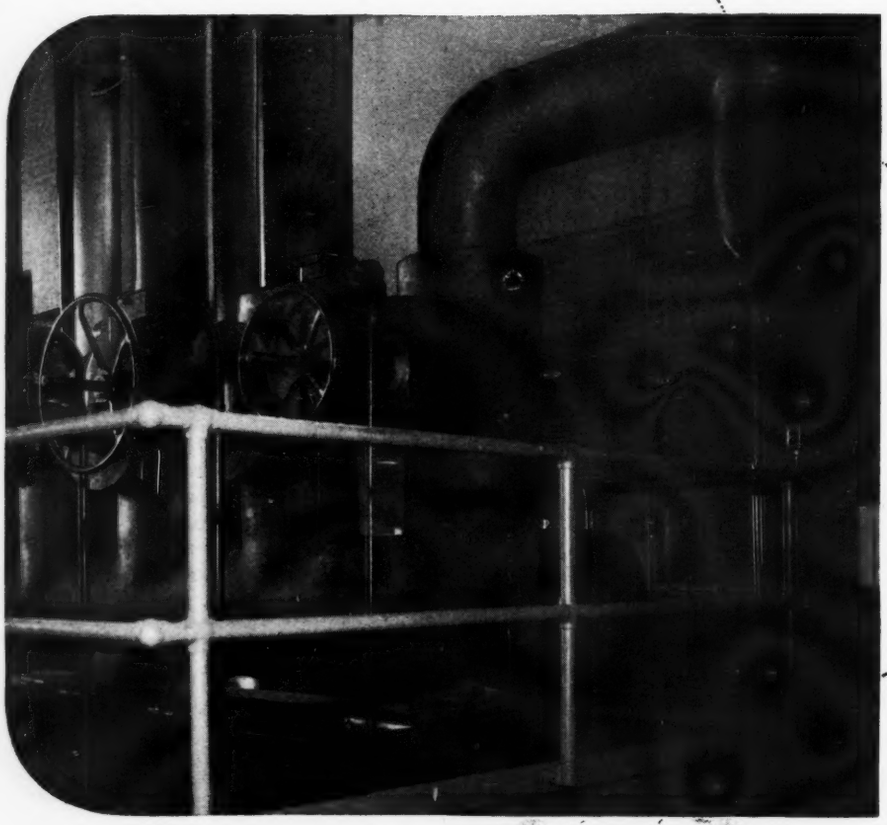
Woolworth Building, New York — Occidental Building, Indianapolis — Peoples Gas Building, Chicago — Union Guardian Building, Detroit

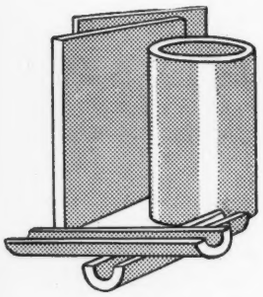
Public Square Building, Cleveland — Liberty Life Building, Charlotte — 10 High Street, Boston — 525 Market Street, San Francisco

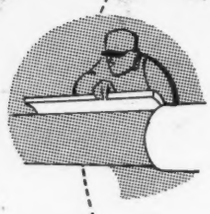
SOUND REASONING RECOMMENDS: unibestos



unibestos pipe insulation is being used in production-minded plants the country over for five basic reasons: first, higher thermal efficiency; second, half-section construction for all pipe sizes up to 36", thicknesses up to 5"; third, Standard and Super material are available in single layer construction with provision for expansion in piping; fourth, greater structural strength—won't soften, shatter or shake-down even under the most severe conditions; and fifth, because it is easy to apply and saves time in application.



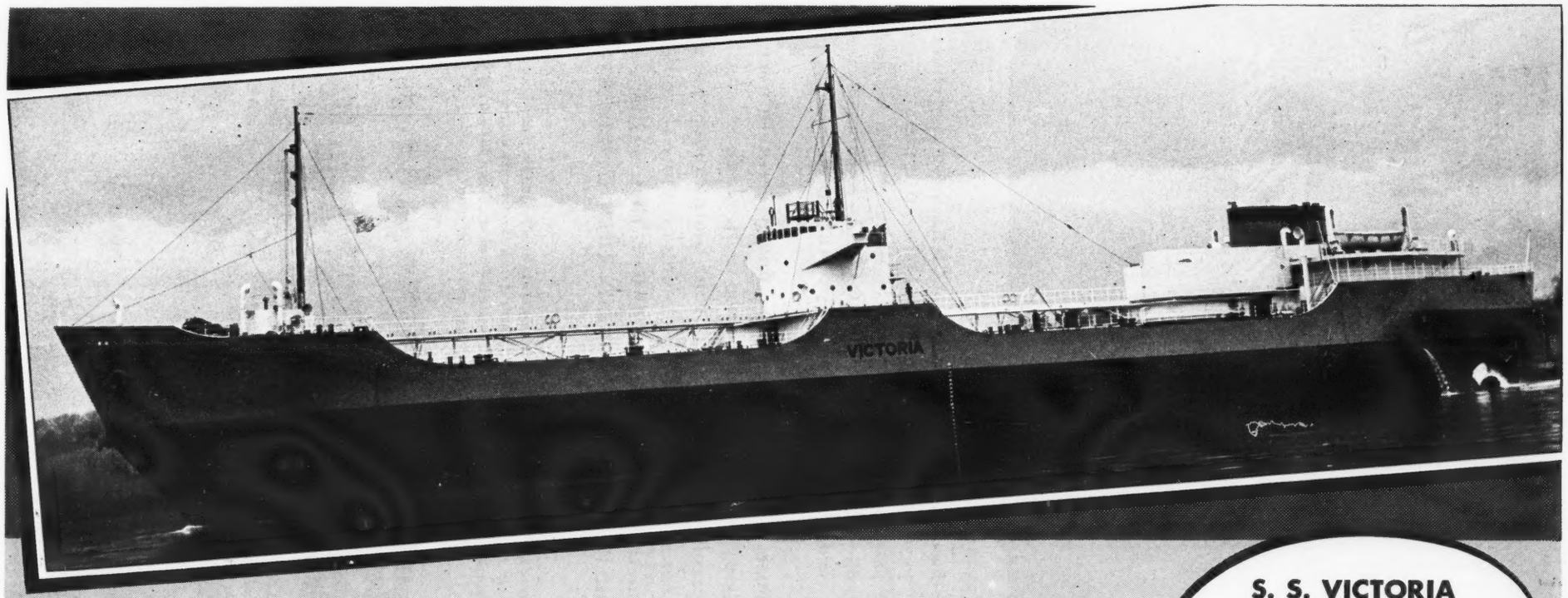




unibestos thermal efficiency has been independently investigated by authorities of many leading technical schools. These tests have proven conclusively the superiority of Unibestos, the Amosite asbestos insulation. Copies of these reports, along with a ready-reference-table of required insulation thicknesses; table of Unibestos sizes and list prices; a check-list of Unibestos features, are available in the new bulletin "They'll Specify Unibestos". For your copy, write . . .

UNARCO

UNION ASBESTOS & RUBBER CO. Factory & General Office: 1821 S. 54th Ave., Cicero, Ill.
NEW YORK: 420 Lexington Ave. • SAN FRANCISCO: 420 Market St.



Induced Draft by CLARAGE

S. S. VICTORIA

Designed by George G. Sharp, Naval Architect and Engineer, New York City. • Built by Cargill, Inc., Albany, New York.

This new Diesel engine driven tanker is equipped with a Babcock & Wilcox boiler which supplies steam for heating the cargo bunker oil so that it can be easily pumped from the ship when port is reached — boiler operated only as ship approaches port — steam circulated through coils installed in cargo bunkers. Steam from the boiler is also employed for heating water which is used for cleaning bunkers when oil is out.

Induced draft for the boiler is handled by a Clarage Type RT Induced Draft Fan. A Clarage Fan of this kind is exceptionally compact and adaptable for direct drive — water-cooled bearings and extra heavy construction assuring dependable operation.

On land or on Sea—wherever mechanical draft is required —Clarage Fans can handle the job. Our experience, which goes back to World War I, can help you meet any air handling problem satisfactorily and in time!

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
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FACTORY HEATING
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MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

★ **CLARAGE FAN COMPANY** KALAMAZOO, MICHIGAN ★

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Bronze is more precious than gold. It has become important to you, then, as a user of Bronze Valves, that Pratt & Cady patented the Bronze Globe Valve with renewable seat and disc—and that Reading-Pratt & Cady have continually developed the principles of that patent.

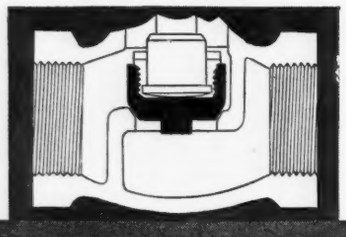
★ For example, when, through long use, a Bronze Globe Valve finally becomes worn, you don't need to replace the stout body of special hard bronze or the high strength rolled bronze stem. They are still in excellent condition. . . . Your maintenance job is limited to first regrinding to a fresh seat and then, finally, replacing no more than the seat and disc—using a minimum of metal that is scarce and of time that is vital. . . . So don't even think of *replacing* your Bronze Valves—MAINTAIN THEM CAREFULLY—REPAIR THEM—RENEW WORN PARTS.

If we can be of practical service, we'd like to help—in spite of the pressure of manufacturing schedules filled to capacity with the business of America at war. If we can, we will. Let us have the details of what you believe should be done for your valves.

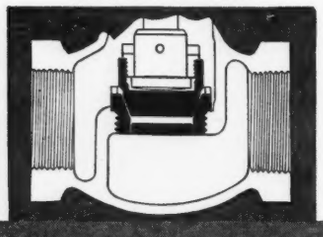
As a matter of service to America, may we suggest that you sort all metal scrap carefully, protect it from the elements and pass it back to industry through a responsible dealer. Make this part of your program. There is a tragic shortage of scrap.

READING-PRATT & CADY
READING, PENNSYLVANIA

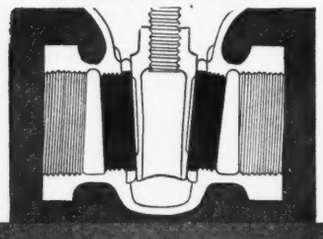
REGRINDING GLOBE VALVE
REGRIND AND RENEW



SEMI-PLUG TYPE GLOBE VALVE
REGRIND AND RENEW



BRONZE GATE VALVE
REVERSE WEDGE—RENEW



A Division of AMERICAN CHAIN & CABLE COMPANY, INC. Bridgeport, Conn.

PHOSCALOID

A GOOD BUY *Because it...*

PROVIDES phosphate with no scarcity in sight, and in liquid form, weighing 15 pounds per gallon. This can be fed uniformly, and in large amount, through one nozzle feeder to any number of boilers by means of the Rice System, and at about the lowest initial feeder equipment expenses obtainable.

HAS not been increased in price over those normally existing before the war.

OFFERS phosphate strengths approximating commercial anhydrous disodium phosphate.

SUPPLIES this high phosphate value in chemical union with Proteins that possess properties for removing calcium from feed waters equal to any commercial phosphates.

COMBINES Proteins with calcium, thus forming structureless combinations of the most effective type for destroying the cementing properties of both liquid and solid silicates.

ATTACKS the solution of Silica problems from every angle, in which the phosphate ion removes calcium and protein, and through its reactive, adsorptive, and mechanical means definitely keeps the chemical precipitates in the liquid state so necessary for their effective removal through the boiler blowdowns to waste.

LENDS a flexibility in the production of mono, di, and trisodium phosphate, or any combination of these through the use of soda ash or caustic soda that will meet any boiler feedwater problem.

OBVIATES all feed line and pump deposits.

IS both basic and acidic in its properties, forming either calcium proteinate or protein phosphate, thus providing means for the full phosphate conditioning of over-alkaline treated waters from softeners without adding additional sodas to these waters.

DOES all this at costs frequently 40% less than other phosphates.

WRITE FOR BOOKLET

CWR

CYRUS WM. RICE & COMPANY

PITTSBURGH WATER CHEMISTS and ENGINEERS **PA.**

"TOLEDO" PIPE TOOLS MAKE YOUR WORK EASIER

They operate easily because of their proven design. Fewer moving parts reduces friction and assures longer wear.

"TOLEDO" gives you the benefit of their more than 40 years' experience in fine pipe tool construction.

Easy to operate. Low cost. Long life. Specify "TOLEDOS" at your nearest dealer.

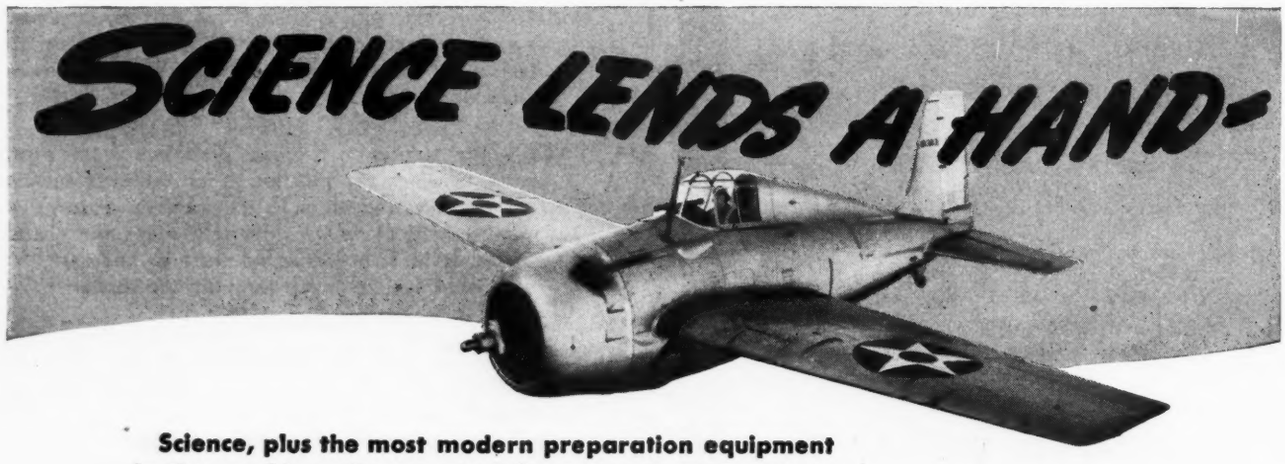
THE TOLEDO PIPE THREADING MACHINE CO.

TOLEDO, OHIO — **NEW YORK OFFICE, 502 NO. 2 RECTOR STREET BLDG.**

"TOLEDO"

TRADE-MARK REGISTERED U.S. PAT. OFFICE

SCIENCE LENDS A HAND-



Science, plus the most modern preparation equipment in the world, and accurate laboratory control assures the *consistent* steam producing qualities of this finer fuel. We will be glad to serve you.

IT'S THE BEST

Champion Coal

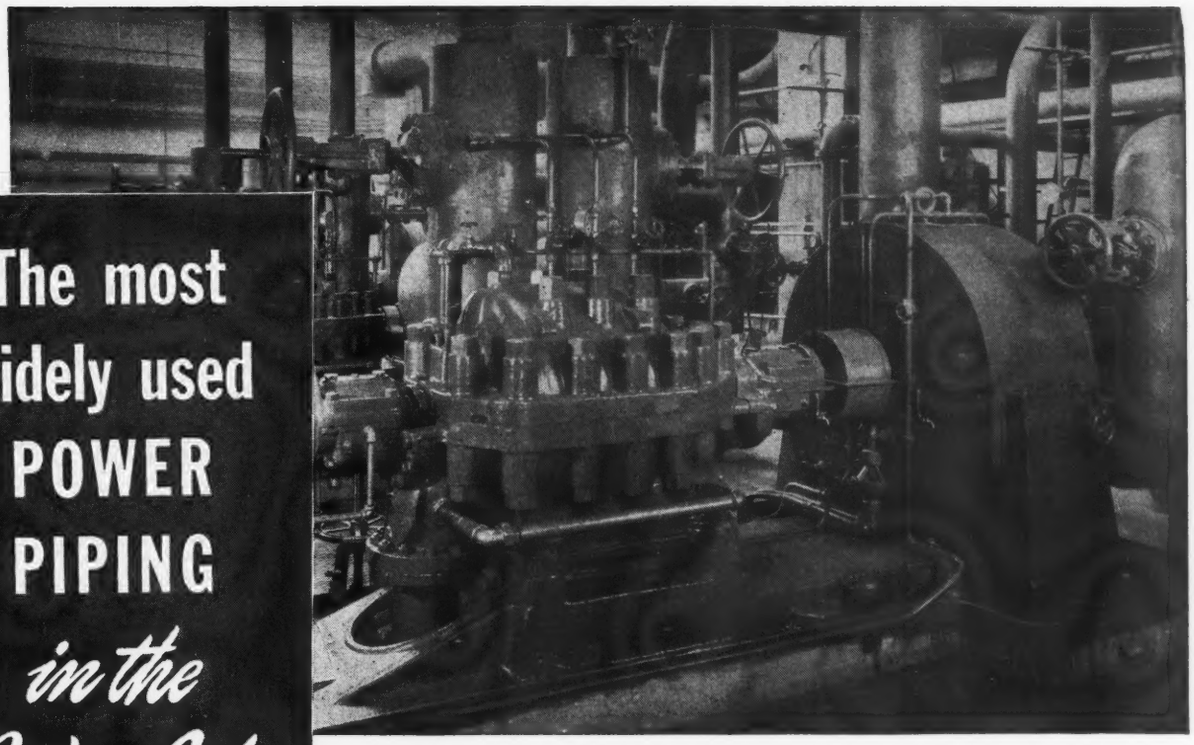
PITTSBURGH COAL COMPANY

GENERAL OFFICES: OLIVER BUILDING · PITTSBURGH, PA.

Cleveland, O.; Sault Ste. Marie, Mich.; Buffalo, N. Y.; Utica, N. Y.; New York City; Philadelphia, Pa.; Youngstown, O.

PITTSBURGH COAL CO., LTD., London, Ont., Hamilton, Ont., Toronto, Ont., Windsor, Ont.

PITTSBURGH COAL CO. of Wisconsin, Duluth, Superior, Minneapolis, St. Paul · MILWAUKEE-WESTERN FUEL COMPANY, Milwaukee, Wisconsin



The most widely used POWER PIPING *in the World*

WALLS WITHOUT WELDS

NATIONAL SEAMLESS POWER PIPING

. . . because it has proved its superiority in high pressure and high temperature service

MORE far-sighted engineers and industrial power experts prefer to work with NATIONAL Seamless than any other pipe. No other pipe has been able to offer a higher degree of safety and workability, or greater length of service in the presence of the new high temperatures and pressures. Countless installations all over the country—many under the most severe operating conditions, are convincingly demonstrating the outstanding ability of NATIONAL Seamless. Several industrial plants have reported operating pressures as high as 2,500 psi and temperatures up to 900°F. And NATIONAL Seamless makes these new records possible.

NATIONAL Seamless has no weld—no line of potential weakness to limit safe operating pressures. Each length is a homogeneous steel cylinder pierced directly from a billet of highest quality steel. Since only sound and flawless steel can successfully withstand this piercing method, this is your assurance of uniform physical properties, uniform wall strength and dimensional accuracy. So, whether you're planning a new system or making repairs to an old one, NATIONAL Seamless will give you longer, safer, more economical service.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

FOR BRUTE STRENGTH

RIC-WIL CONDUIT

For Underground Steam

Ric-wiL Insulated Pipe Units derive their basic strength from heavy gauge Armco Pure Ingot Iron, helically corrugated and formed into a cylinder. The lock-seam, parallel with corrugations, is formed by folding over the adjacent edges of the metal—which is in itself a strong reinforcement. These units have inherent strength far above average installation requirements, even in fairly shallow trenches, and under railroad tracks. Heavy surface traffic, such as bombers, trucks, and motorized equipment will not damage properly installed Ric-wiL Units. Engineering details on request. This long-lived conduit has the further tough protection of heavy asphalt. Factory pre-fabricated by skilled labor, correctly designed, Ric-wiL Units are complete and ready to install for defense projects. No delays! No turmoil! No headaches! Size of units and type of insulation subject to specifications. Wire for name of nearest Ric-wiL representative—he is on the alert to give you ACTION!

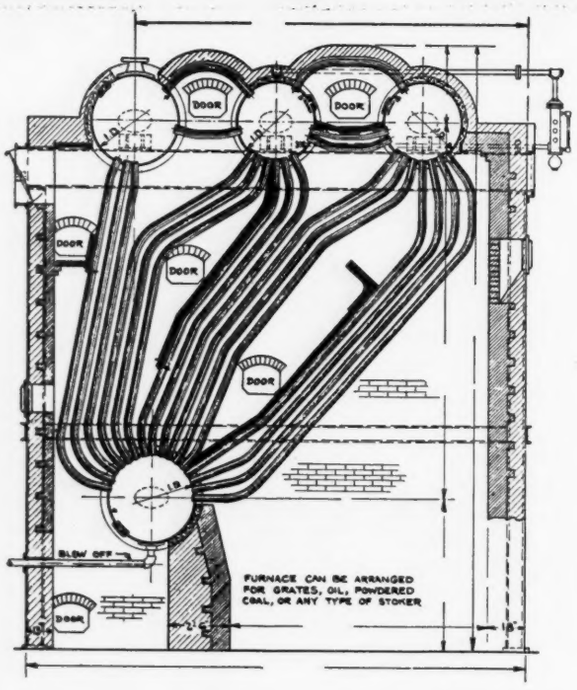
Engineering tests prove that, under railroad traffic, Armco Hel-Cor Conduit of 16 gauge, in the 15″ diameter size, with 30″ of earth fill above top of conduit, will easily support a "Cooper's Loading" of E-90—which equals a uniformly distributed surface load of 3600 lbs. per sq. ft., plus 50% impact.

"Keep 'Em Flying!"

THE RIC-WIL CO.

INSULATED PIPE UNITS
CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

MURRAY



This MURRAY 4-Drum Bent Tube Boiler designed for double flow circulation is being met with great enthusiasm. This boiler is especially designed for sudden over-load demands and high ratings.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

JOHN CRANE WRITES "Last Line" ON CONDENSER packings...

. . . "most modern! easiest, quickest to install! leak-proof under Naval, Marine and Stationary peak-load demands!"

NO FERRULES! (For new and old condensers)

TUBE-END DESTRUCTION

. . . leakage, disappearing vacuum, lay-ups and costly retubing—is the heavy price exacted by unscientific condenser packings. Today, corset-lace, grommets, fibre and ferrules yield to precision engineering—to the John Crane method of sealing tube-ends with metallic condenser-tube packing.

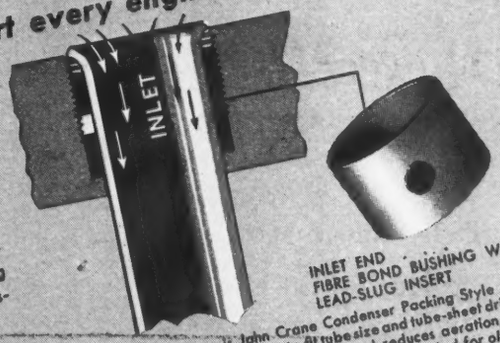
10,000 INSTALLATIONS throughout the world are the final testimony; it should convert every engineer to John Crane

. . . . The John Crane method bonds the tube to the tube-sheet with endless metallic and fibre-expansion rings, ELIMINATING FERRULES! Permits free expansion and contraction of outlet tube-ends and easing of stress on plates; prevents creeping at inlet ends; eliminates electrolytic action; increases efficiency in heat transfer equipment; outlasts tubes. John Crane Condenser Packings end erosion, tube-spinning, metal fatigue, grommet-necking, dezincification, decomposition of cord and linen packings—ends the repacking of both old and new condensers . . . (Note: also adaptable to systems using ferrules; installed twice as fast as corset-lace).

NAVAL, MARINE AND STATIONARY SERVICE

. . . Hundreds of condensers on vessels of the United States Navy and Coast Guard, the British and other leading navies, on merchantmen and in industrial plants—are "John Crane Packed" and are performing flawlessly under "engagement" peak-load demands . . . Specifying "John Crane" in the past was foresight which now is paying out priceless values in uninterrupted service. Today, the selection of "John Crane" is practically a "must!"

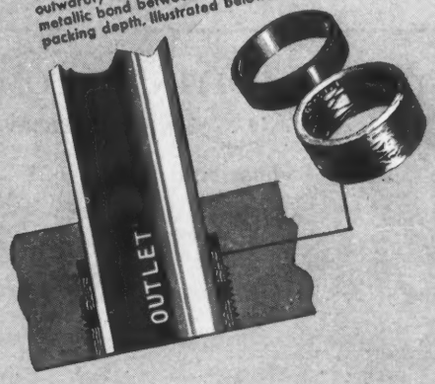
CRANE PACKING COMPANY, 1800 Cuyler Avenue, Chicago
CRANE PACKING COMPANY, LTD., Hamilton, Ontario, Canada



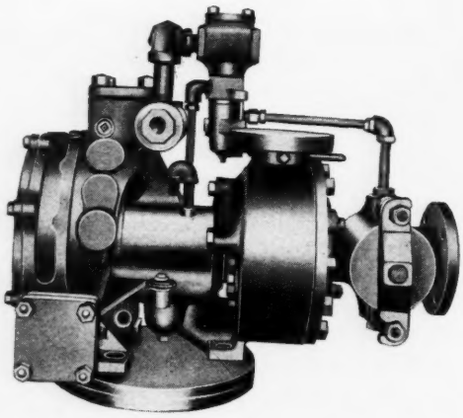
INLET END FIBRE BOND BUSHING WITH LEAD-SLUG INSERT

Ring above is John Crane Condenser Packing Style 603. Accurately machined to fit tube size and tube-sheet drilling. Bonds tube-end. Belling tube-end reduces aeration, produces top hydraulic efficiency. Recommended for old condensers. Cross-section shows lead-slug insert and fibre expansion ring flown into drilling . . . On the inlet end of new condensers, tube-end is expanded into tube-sheet and belled. No packing necessary.

OUTLET END ELIMINATING FERRULE—Outlet ends of both old and new condensers are packed alike—eliminating ferrules. Cross-section shows installation of John Crane Endless Metallic Rings Style 601-E (special babbitt foil) and Vulcanized Fibre Expansion Ring Style 602-G. When caulked, these rings flow inwardly around the tube and outwardly into the drilling threads, forming a perfect metallic bond between the tube and tube-sheet. Greater packing depth. Illustrated below.



JOHN CRANE
CONDENSER PACKINGS



COFFIN—*Steam Turbine*
CENTRIFUGAL PUMP

Single Stage—High Pressure

For Boiler Feed and General Pressure Service

Deliveries to 500 G.P.M.
Pressure to 750 Lbs. Sq.In.

Send Coupon for Particulars

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

Please Send Bulletin I-21

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Company .....

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PIPEWRENCH PETE SAYS:

Here's NEWS about
CONTINUOUS BLOW DOWN!

NEW ACCURACY NEW ECONOMY!

NEW ACCURACY!
Visual metering, plus restricted seat.

NEW ECONOMY!
Anum-Metl "X" seat and disc last longer than Anum-Metl!

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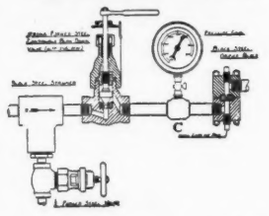

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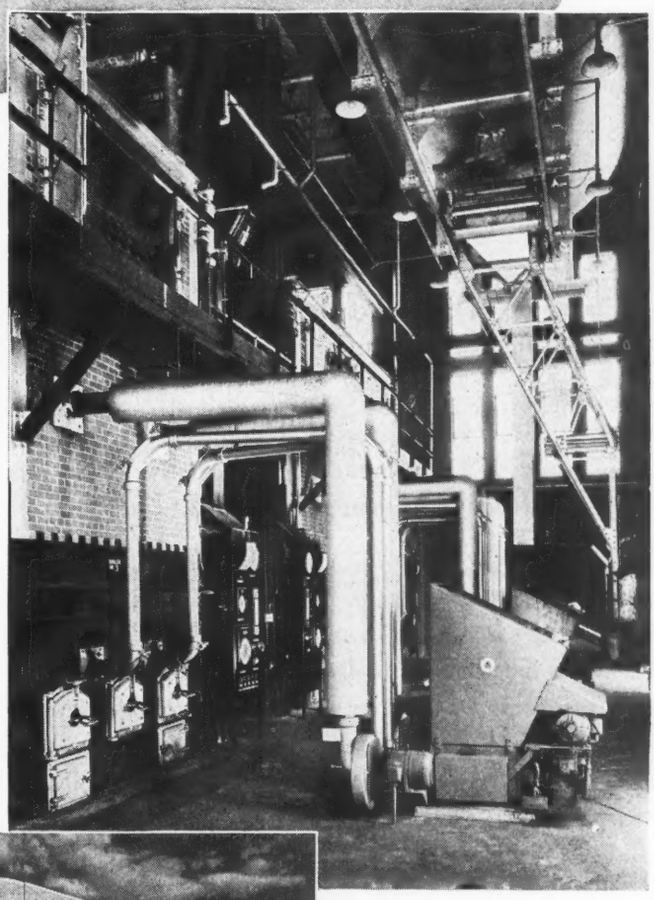
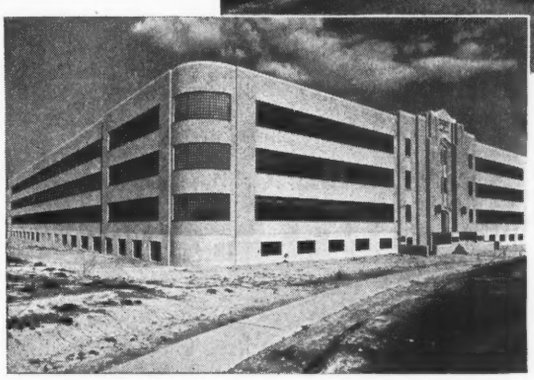
THIS is a highlight from a recent article in "Power", written by T. A. Marsh, author of "Combustion in the Power Plant." He describes the operation of three 2000-lb. per hour, Iron Fireman dual-feeder, pneumatic-spreader stokers in the U.S. Department of Agriculture's laboratory at Wyndmoor, Pa.

"Each stoker has two feed worms driven by a 1½ h.p. motor through variable-speed pulleys in combination with a three-speed transmission," the report continues. "The feed worms meter the coal to transfer housings, from which gas streams convey it to the furnace. The fines burn in suspension and the larger pieces form the fuel bed. The nozzles which deliver coal to the furnace have adjustable tips for distribution control, insuring uniform spreading over the grate area.

"Maximum turbulence is the result because the conveying stream enters the furnace at right angles to the flow of forced-draft gas from the fuel bed."





Notice the clear boiler fronts in the Wyndmoor Laboratory. Coal is fed to the Iron Fireman Pneumatic Spreader hoppers by traveling weigh lorries. These boilers are straight tube, vertically baffled, with box header. They are nine high by twelve wide single drum units with 4" diameter tubes. Each of the three contains 2,000 sq. ft. of heating surface. No economizers, water-walls, preheaters, or superheaters are used.

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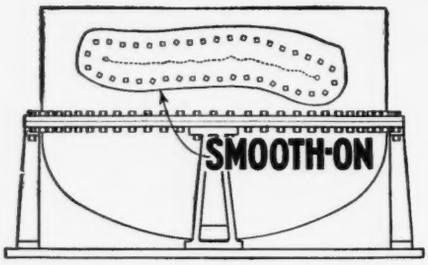

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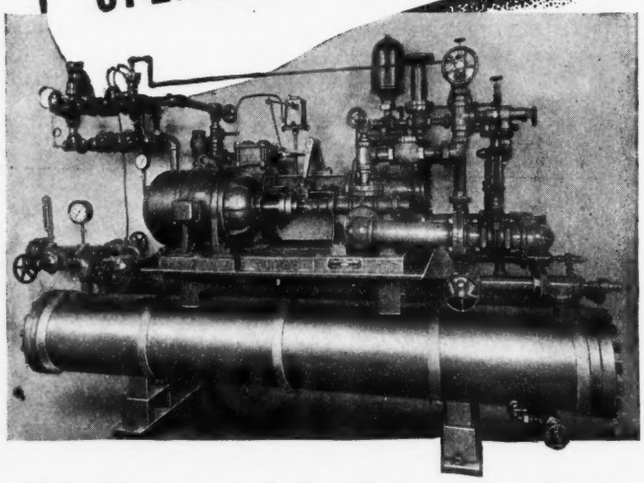

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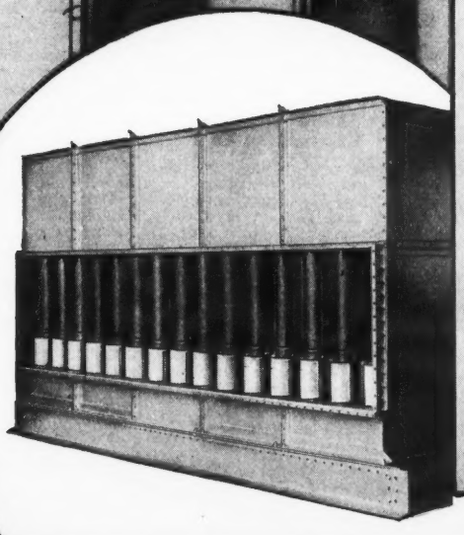

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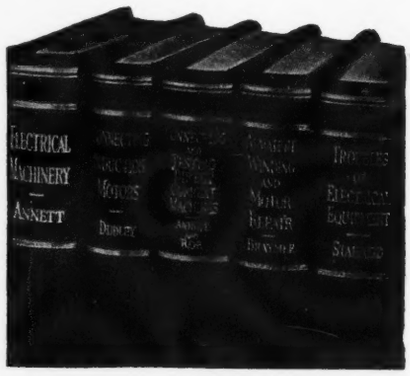

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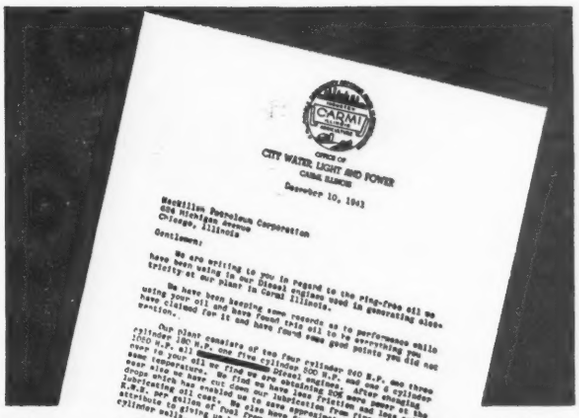

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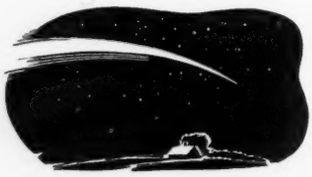

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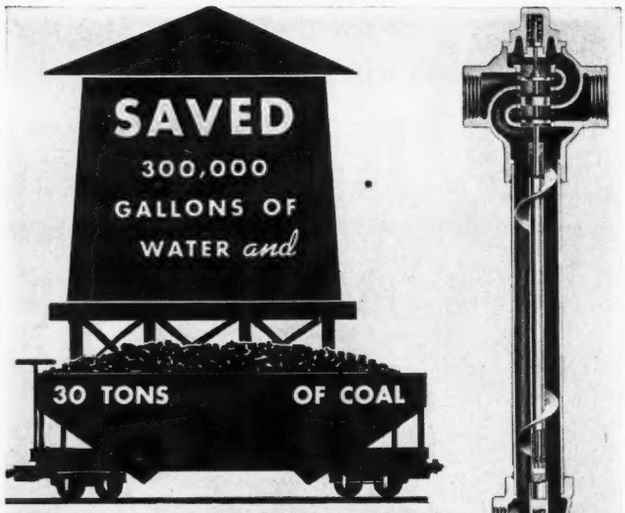

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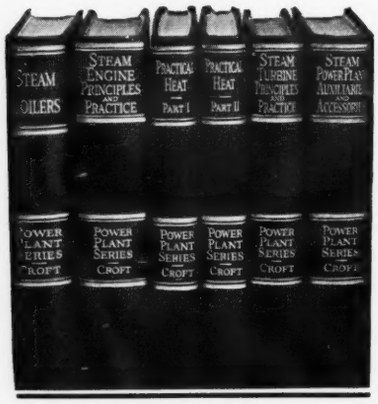
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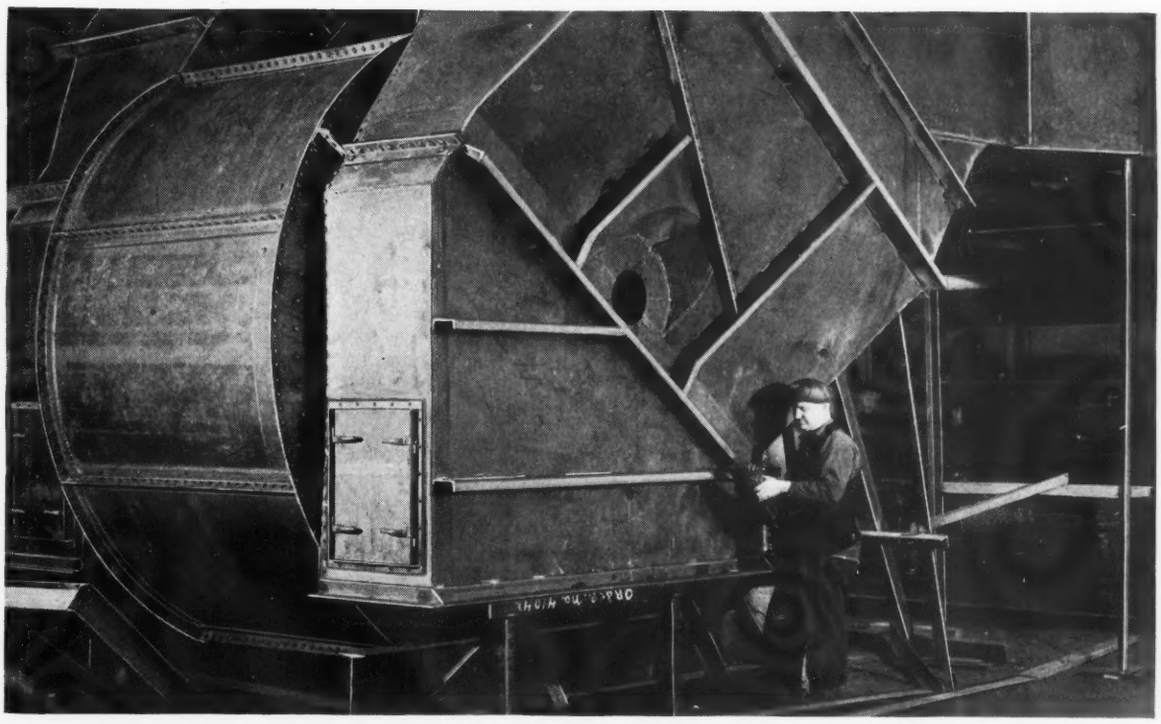

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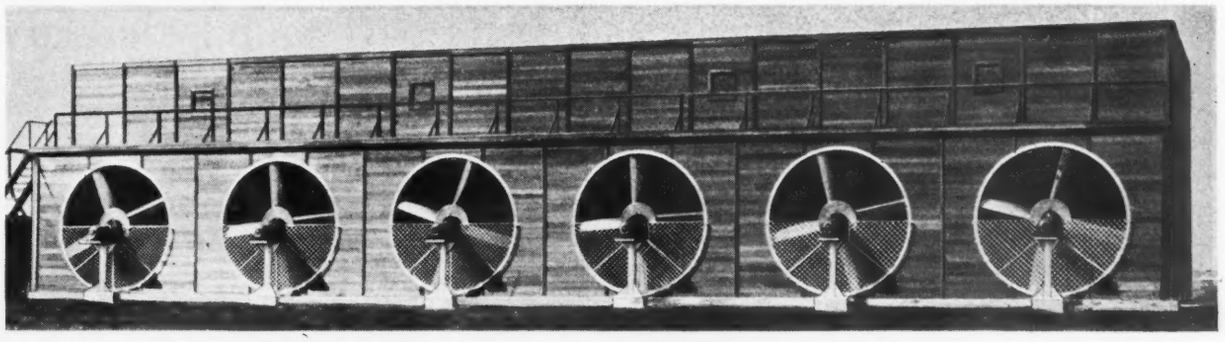
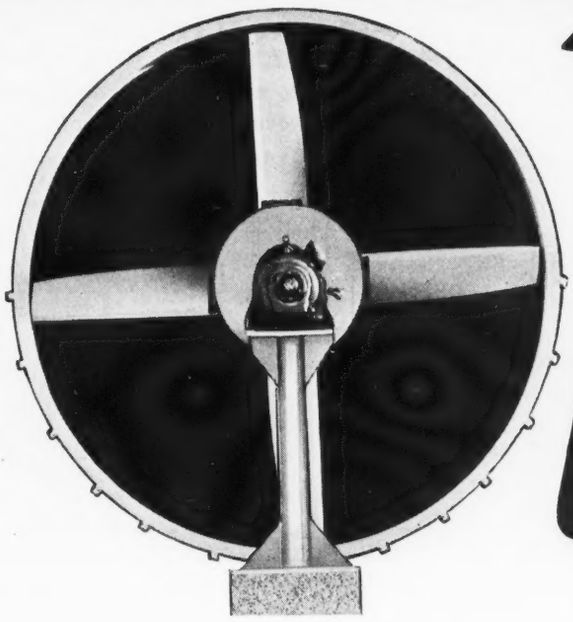
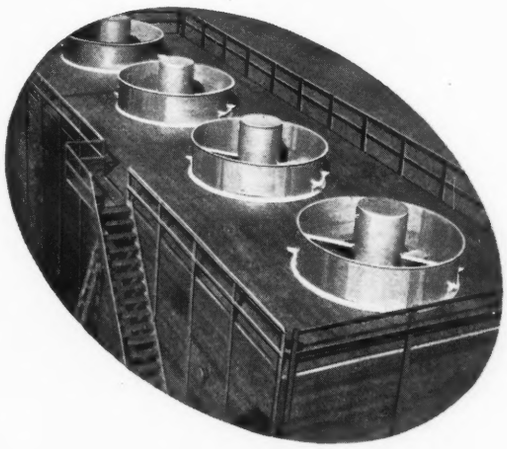




Here's ONE Big Reason For PRITCHARD Mechanical Draft EFFICIENCY AND ECONOMY



MORE than two years ago Pritchard designed the high efficiency, "featherweight", axial flow monel metal fans used since that time on all Pritchard mechanical draft installations. Today these fans are recognized as an outstanding contribution to mechanical draft efficiency and economy.

They are non-corrosive; don't pit. They are economical of power; reduce driving equipment wear. They provide uniform air flow across the entire fan opening.

Because of these fans, and other features, the operating cost of today's Pritchard towers has been reduced to new low levels.

Get the facts. Write for Bulletins No. 42 and 42-A.

J. F. PRITCHARD & COMPANY

Dwight Building **Kansas City, Mo.**

Branch offices in Tulsa, Okla.; Houston, Texas; Atlanta, Ga.; Chicago, Ill.; Pittsburgh, Pa.; New York City

PRITCHARD

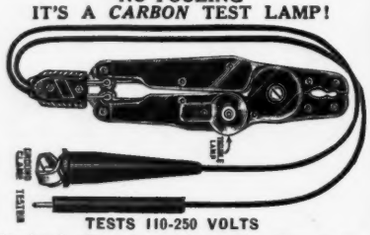
Atmospheric and Mechanical Draft

WATER COOLING TOWERS

WHERE TO BUY

Featuring additional products and specialties for power plants

NO FOOLING
IT'S A *CARBON* TEST LAMP!



TESTS 110-250 VOLTS

Insulated pliers for testing and pulling fuses. Folding prongs fit base plugs. Test cord attachable. Model B tests 110-600 Volts.
Can be obtained from G.E.—Westinghouse, or other first class jobbers.

STAR TEST POCKET PLIERS
235 Canal St. New York, N. Y.

VOSS VALVES
INCREASED CAPACITY, SAVINGS IN POWER, SAFETY OF OPERATION
Made for all sizes of ammonia, air and gas compressors.
Send for estimates, literature and references.
J. H. H. VOSS CO., 785 East 144th St., New York, N. Y.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

A Good Habit

This "Where to Buy" Section supplements other advertising in this magazine. .

It's a good habit to check this page—every issue.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
REFRACTORY CEMENTS
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA St., Buffalo, N. Y.

SUHM
PRESCRIBED BOILER TREATMENT
SAVES $600.00
A Month for Local Firm
For free analysis of raw boiler water send jugful of boiler water to SUHM CO., INC., 1942-50 S. Kinnickinnic Ave., Milwaukee, Wisconsin.
Fine Territories Open To Experienced Salesmen

PROFESSIONAL SERVICES

Consulting Valuations Reports — Developments Appraisals Construction — Designing Testing Financing — Inspections Cost Analysis Investigations

HALL LABORATORIES, Inc.
R. E. HALL, Ph. D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. Pittsburgh, Pa.

SARGENT & LUNDY
ENGINEERS
140 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS

THE J. G. WHITE ENGINEERING CORPORATION
ENGINEERS — CONSTRUCTORS
New York, N. Y.

LANCASTER, ALLWINE & ROMMEL
Patents—Copyright—Trade Marks
Booklets—"General Information Concerning Inventions & Patents" and "Fee Schedule" sent without obligation.
Established 1915
Suite 456, 815—15th St., N.W., Washington, D. C.

J. E. SIRRINE & COMPANY
Power Plants *Engineers* Consultation
Design Reports
Water Steam Utilization Plans
Greenville South Carolina

JOHN A. STEVENS, Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
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J. H. MANNING & COMPANY
ENGINEERS
Business Studies, New Projects, Purchase-Sales, Management, Valuations, Reorganizations, Mergers, Public Utility Affair (including Integration)
120 Broadway New York — Field Building Chicago

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
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For Safe Boiler Operation

The Genuine **Squires**

Boiler Feed Water Controller

will maintain a constant water level in your boilers and will feed them in proportion to the evaporation.

Write for Catalog A-12 now

The feed valve is operated by boiler pressure —insuring positive functioning.

Squires

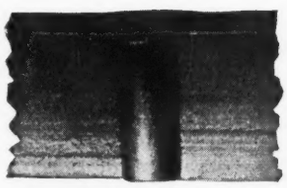
Trade-Mark Reg. U. S. Patent Office

THE C. E. SQUIRES COMPANY

East 40th St. and Kelley Ave., Cleveland, Ohio

Here is PROOF that WEDGE Split CHILL RINGS give you 100% Penetration

The unretouched photos below prove that WEDGE Chill Rings with the patented SPLIT Feature assure 100% penetration. The operator always penetrates to the INSIDE OF PIPE with the first layer of welding material. WEDGE Chill Rings not only give you a STRONGER joint, but you can weld FASTER. It will pay to investigate.



100% penetration

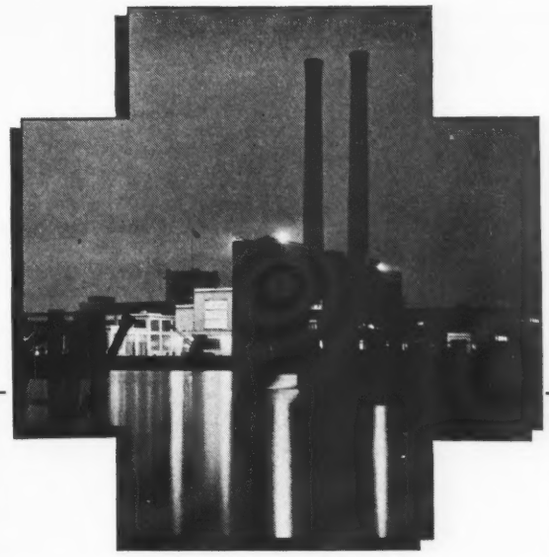
50% penetration

Write for Circular and Prices

WEDGE PROTECTORS, INC.

9524 Richmond Ave. **Cleveland, Ohio**

WEDGE CHILL RINGS SAVE MONEY



FIRST AID TO ALL-OUT OUT-PUT

Efficient Mineral Wool Insulation

Wasted fuel — reduced power output — fluctuating temperatures are peace-time luxuries that American industry can't afford today. That's why more and more plants are specifying and installing *efficient* Mineral Wool Insulation. That's why uninsulated flanges, fittings, breechings, ducts, etc., are being covered with this more economical insulation.

SEVEN REASONS-WHY

1. **EFFICIENCY.** Mineral Wool Insulation has low thermal conductivity. Its resilient fibers entrap a maximum of "dead-air" . . . nature's own best insulator.
2. **EASY TO APPLY.** Lightweight. Easy to handle. Doesn't pack-down. Each pound covers more surface more efficiently.
3. **LONG LIVED.** Does not become brittle or fragile; does not disintegrate physically or chemically or lose its insulating efficiency at recommended industrial operating temperatures.
4. **FIRE RESISTANT.** Made entirely from mineral fiber, it cannot burn nor support combustion.
5. **WATER REPELLENT.** Virtually non-absorbent, Mineral Wool Insulation undergoes no physical or chemical change when exposed to humidity or moisture.
6. **CONVENIENT.** Mineral Wool Insulation is available in bulk, in blankets, in blocks and as insulating-cement. Prominent producers have ample stocks in nearby distributors' stocks.
7. **LOW COST.** No other insulation does so much for so little

Conserve America's natural resources . . . cut operating costs . . . increase production . . investigate the many advantages of *efficient* Mineral Wool Insulation for piping, valves, fittings, boiler and furnace walls, heaters, ducts, tanks and processing equipment.

Write now for data on Industrial Mineral Wool Insulation.

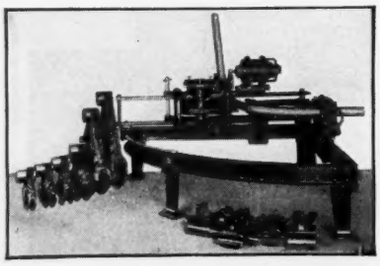
INDUSTRIAL MINERAL WOOL INSTITUTE

441 LEXINGTON AVE. • NEW YORK CITY

FREE — Interesting quarterly-publication "Efficiency" upon request. Write or use coupon below.

Name_____

Address_____



FOR NATIONAL DEFENSE

We Are Ready To Serve You

The American Cold Pipe, Conduit and Tube Bending Machines

New Special Bender for thinnest wall tubing from 1/64 down. Used with the new Cerrobend filling.

Another new bender for extra heavy pipe up to 3".

Quick Deliveries . . .

Hand Operated Types in capacities of 1 in., 2 in., 3 in., and 4 in.

Motor Operated in three capacities, ½ in. to 4 in., ½ in. to 6 in., and ½ in. to 8 in.

IMMEDIATE SHIPMENTS on hand operated machines; on motor powered from two to four weeks.

Wire or air mail letter for printed matter and prices.

AMERICAN PIPE BENDING MACHINE CO., INC.
23 Pearl Street Boston, Mass., U. S. A.

SERVICE STRIPES

WE HAVE THEM FOR 4 WARS

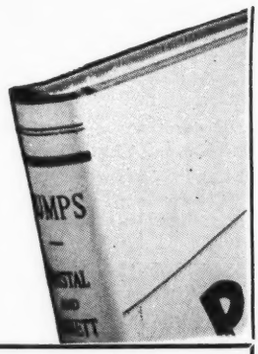
Jarecki was nine years old when the Civil War began, 46 years old when the Spanish-American War opened and 65 years old when America entered the first World War. . . . And now, embarking on its 90th year, Jarecki has enlisted in still another war—the struggle of free men against the evil forces of oppression.

In this struggle, as in previous wars, Jarecki's policy is clear-cut and plain: to place national interests first but at the same time to do our best, within the limits imposed upon us, to serve our civilian customers.

JARECKI
MANUFACTURING COMPANY
ERIE, PA.

. . . NO MORE pump troubles

Here's a new McGraw-Hill practical book to help you avoid pump breakdowns, pump inefficiency, pump expense, through better selection, operation, and maintenance of pumps for any purpose. Gives you a wealth of usable information on all types of pumps, regular and special, their performance, service limitations, how to make your specifications clear, how to install, operate, and maintain pumps, how to locate and remedy pump troubles, etc.



Kristal and Annett's **PUMPS**

TYPES, SELECTION, INSTALLATION, OPERATION, and MAINTENANCE

THIS is a book for the pump user to consult in selecting and buying his pumps, for the manufacturer in insuring adequate fulfillment of specifications, for the operator in securing maximum efficiency and locating and remedying troubles quickly.

What makes a pump work? What type of pump is suitable for a specific task? How can you estimate the head against which a pump must work? For most economical pump operation, how do you calculate pipe sizes? What type piston, plunger, valve, roller, crescent, sliding vane, wobble plate, etc., etc., should be incorporated in the pump to best fit *your* needs? These questions, completely answered in Kristal and Annett's book, indicate the thorough and practical help it gives.

A special chapter shows in detail how to overcome one of the most important problems in pump efficiency and cost by showing how to estimate the head against which they must work and the size of suction and discharge pipes.

Complete data on:

ASH-HANDLING PUMPS
BOILER-FEED PUMPS
CHEMICAL PUMPS
CONDENSATE PUMPS
DEEP-WELL PUMPS
HOT-OIL PUMPS
MASH PUMPS
MINE PUMPS
OIL-FIELD PUMPS
PROPORTIONING PUMPS
SAND PUMPS
SEWAGE PUMPS
and many others

339 pages, 6 x 9, 385 illustrations, $3.50

The A B C of Pumps

18 big chapters covering

- **types of pumps available and their characteristics**
- **how to select and install them**
- **how to operate and maintain them**

10 DAYS' FREE TRIAL SEND THIS COUPON

McGraw-Hill Book Co.,
330 W. 42nd St.,
N. Y. C.

Send me Kristal and Annett — Pumps, for 10 days examination on approval. In 10 days I will send $3.50 plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....

Address .....

City and State .....

Position .....

Company FP-3-42

(Books sent on approval in U. S. and Canada only.)

It Costs 30% TO 60% Less* TO OPERATE

Hovalco Angle Valves used in combination with (1) Homestead Lever Seald or (2) Cam Seald Quarter-Turn Valves meet the requirements of A. S. M. E. Code and all state laws for boiler blow-off service. Made in 1½"—2"—2½" sizes for pressures up to 600 pounds.

HOVALCO
"Double-Life" Blow-off Valves

*Certified reports from users of Homestead Boiler Blow-off Valves show 30% to 60% lower operating costs, as compared to valves previously used.

This extremely low upkeep, plus *double valve life* afforded by the *extra* set of ready-ground and perfectly matched high-silicon-monel seating surfaces in every Hovalco Angle Valve, is your assurance of lowest-cost-per-year valve service.

Be sure that you meet today's increased power demands by specifying and getting the unfailing service and lower costs afforded by Homestead Blow-off Valves. Select the proper sizes and types for your conditions from Homestead Valve Reference Book No. 38. A copy will be sent at your request.

HOMESTEAD VALVE MFG. CO., P. O. BOX 210, CORAOPOLIS, PA.

HOMESTEAD VALVES

QUARTER-TURN VALVES:
STRAIGHT-WAY
THREE-WAY
FOUR-WAY
LUBRICATED TYPE
LIFT-TYPE PLUG

PROTECTED-SEAT VALVES:
HYDRAULIC (B. & O. PAT.) OPERATING
REMOTE CONTROL
HYDRAULIC DESCALING
ROSS AIR SHUT-OFF VALVES
HOVALCO BLOW-OFF VALVES

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ the above rates.
PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by March 9th will appear in the April issue, subject to limitations of space available.

WANTED

POWER PLANT OPERATORS

For operating pressures of 700 pounds or over. Illinois location. Replies held confidential. Please type. Photograph desired.

P-233, Power
520 No. Michigan Ave., Chicago, Ill.

PLANT ENGINEER WANTED

Responsible position as plant engineer for large textile company with mills in this country and foreign. Headquarters New England. Want steam and hydro power experience and executive ability to organize and operate maintenance shops employing approximately 300 men. Should know modern machine shop practice. Salary equivalent to responsibilities.

P-248, Power
330 West 42nd St., New York City

POSITIONS VACANT

(See also "Selling Opportunity" Offered)

M.E. GRADUATES not over 40 for design and assembly layout of boilers and accessory equipment. Knowledge of descriptive geometry and thermodynamic calculations very helpful. Location, Middle West and East. Applications must include full resume of schooling, firms worked for and details of experience. P-146, Power, 330 W. 42nd St., New York, N. Y.

GRADUATE MECHANICAL ENGINEERS preferably under 40 with practical experience in boiler-room operation and knowledge of combustion problems. No applications considered unless accompanied with complete history of applicant's background and experience. P-147, Power, 330 W. 42nd St., New York, N. Y.

SEVERAL MECHANICAL DRAFTSMEN and tracers wanted, preferably men exempt from draft service; by large industrial plant in Louisiana. P-236, Power, 520 N. Michigan Ave., Chicago, Ill.

GRADUATE MECHANICAL ENGINEERS with several years experience engineering and design, all mechanical phases steam electric stations. Write giving full particulars age, education, experience, salary expected. Employment New York City. P-251, Power, 330 W. 42nd St., New York, N. Y.

YOUNG GRADUATE MECHANICAL engineers, one or two years out of college; good opportunity to learn all phases engineering and design, steam power stations, heat balances, etc. Write giving full particulars age, education, salary expected, previous experience, if any. Employment New York City. P-252, Power, 330 W. 42nd St., New York, N. Y.

CENTRIFUGAL PUMP DESIGNER and engineer, familiar with modern practice. State age, education, experience, references. Address P-253, Power, 520 N. Michigan Ave., Chicago, Ill.

MECHANICAL DESIGNERS: Qualified for power plant design especially piping layouts. Locatiln New York City. State experience and salary desired. P-254, Power, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 32 years recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

MECHANICAL ENGINEER, age 36, graduate, 13 years varied power plant experience from generation to use of all utility services. Experience ranges from shovelling of coal to design of power plant. Desires position of Power Engineer charge of industrial power plant. Now employed as Plant Engineer. Write PW-243, Power, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

SALES ENGINEER for Power Plant Equipment. Preferably graduate chemical or mechanical engineer. Must have knowledge of chemistry as applied to water conditioning. Traveling part of time, Minnesota and vicinity. Deferred classification in draft. Give complete particulars and salary desired in application. SW-255, Power, 520 N. Michigan Ave., Chicago, Ill.

WANTED

SECOND-HAND WOOD GRINDERS, approximately one hundred ton capacity with motors. W-242, Power, 520 N. Michigan Ave., Chicago, Ill.

WANTED

SALES AND SERVICE ENGINEER

A large well established Chemical Engineering and Consulting Organization supplying water conditioning service and chemicals essential to industrial plants, has a few vacancies in its sales and service staff. Qualifications should include—knowledge of chemistry, engineering principles and the ability to meet and talk with people. Compensation on a basis of salary, bonus and expenses, with excellent opportunity for advancement. Our entire staff has knowledge of this advertisement. Address reply

Box **SW-249** Power
330 W. 42nd St., New York, N. Y.

WANTED

Manufacturer's Representatives

To represent established firm manufacturing Boiler Room Specialties. Territory available in Southern States and other parts of the U. S. Sales on liberal commission basis. Reply stating qualifications.

Box **RW-246,** Power,
520 No. Michigan Ave., Chicago, Ill.

PRICE & COMPANY

CONSULTING ELECTRICAL AND MECHANICAL ENGINEERS

Technical Advisers to the Purchasers of Used Steam and Electrical Equipment

Inspection Redesign Reports
Installation Supervision

88 Broad Street, Boston, Massachusetts

ADELBERT B. PRICE
Registered Professional Engineer

All Makes - Types - Sizes

QUICK
DEPENDABLE
LOW COST
GAUGE & VALVE
REPAIRS

UNIVERSAL STEAM GAUGE CO.
285 Broadway, Cambridge, Mass.

VOLTAGE REGULATORS

—"increased load, desired voltage at all load demands, lower operating cost" all due to voltage regulators furnished by you having solved our former troubles" - - - - - - - - - (name upon request)

NEW & REBUILT automatic voltage regulators of all makes for all size DC and AC generators at money saving prices. Prompt shipments. Write your problems today.

Liberal allowance on your old regulator.

Electrical Instrument Exchange
411 N. Ashland Ave. CHICAGO, ILL.

WANTED TO BUY

One (1) 500 or 750 KW 3 phase 60 cycle 2300 volt **Turbo-Generator or Direct Corliss Engine.** Generator 125-150 Lb. With all equipment.

TEMPLE LUMBER COMPANY
PINELAND, TEXAS

WANTED

WATER TURBINE

A good used 1,000 HP Water Turbine, operating on 200 to 230 ft. head. In submitting your offer, please give full details and specifications.

W-245, Power
330 W. 42nd St., New York City

WANTED

GENERATOR SET

250 KW, 3 Phase, 60 Cycle, 220 V., 4 Wire. Engine must be upright.

QUICK SERVICE LDRY. #1 INC.
315 E. 99th St. New York City

WANTED

COLD ROLLED SHAFTING

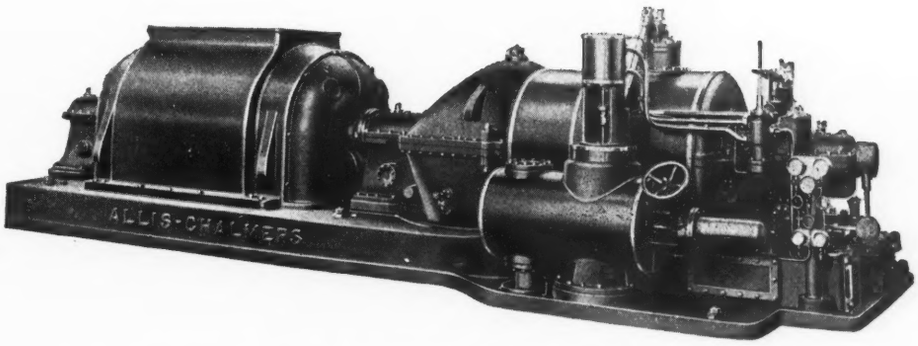
Considerable quantity of used cold rolled shafting, 3-7/16" diameter or 3½" diameter, random lengths. Advise with detail what you have available.

W-228, Power
330 West 42nd St., New York City

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—G.E., 7500-KVA, 3/60/600-2300-v, 250# 575° Maximum. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 1875-KVA, 3/60/480-v, 200#, 500°, Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1000-KW, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

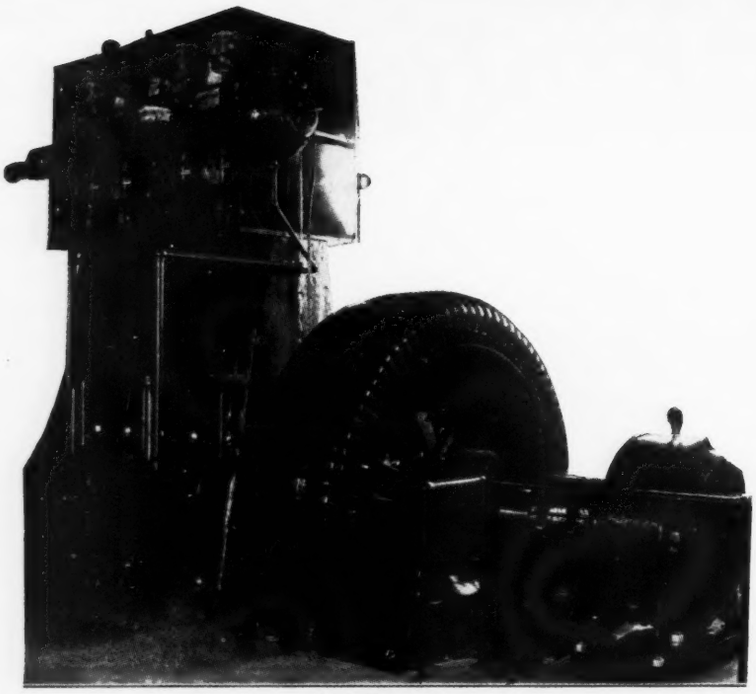
1—G.E., 625-KVA, 3/60/2300-v, 200#, 500°TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Union Guardian Bldg. DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

ELECTRICAL POWE



Actual Photograph

625 KVA AMES VERTICAL UNIFLOW UNIT

625 KVA Westinghouse alternating current generator, 3 phase 60 cycle 2300/600/480/240 volts 300 RPM direct connected to 14"x16" Ames 4 cylinder vertical uniflow non-condensing engine, 150-175 lbs. steam pressure 0-5 lbs. back pressure. Complete with exciter and switchboard

Can be shown in operation

ENGINE GENERATORS

3 Phase 60 Cycle

625 KVA WESTINGHOUSE - AMES 4 cylinder vertical Uniflow, 150-175 lbs. 0-5 lbs. back pressure, 2300/600/480/240 volts.

500 KVA GENERAL ELECTRIC-AMES 4 cylinder vertical Uniflow, 150-175 lbs., 0-10 lbs. back pressure, 2300/600/480/240 volts.

438 KVA GENERAL ELECTRIC-SKINNER Uniflow, 150-175 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts.

210 KVA GENERAL ELECTRIC-AMES Uniflow, 125-150 lbs., 0-5 lbs. back pressure, 2300/-600/480/240 volts.

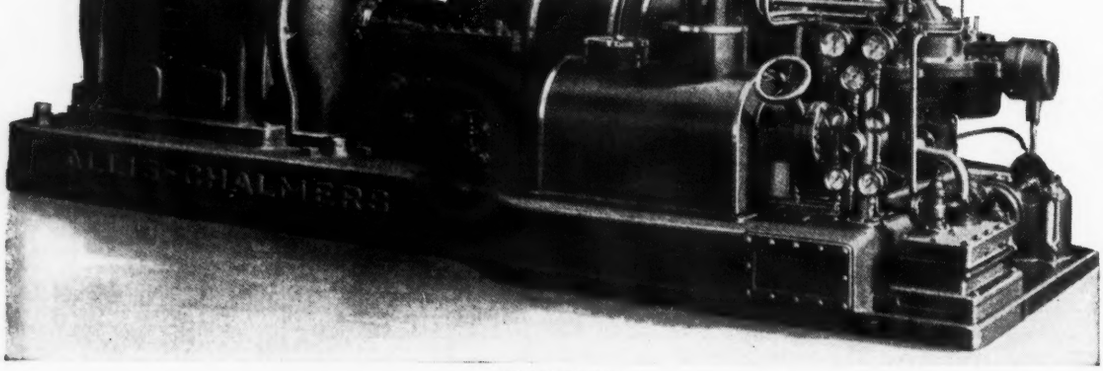
210 KVA (2) GENERAL ELECTRIC - SKINNER Uniflow, 125-150 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts.

ENGINE GENERATORS

125/250 Volts 3-Wire D.C.

150 KW CROCKER WHEELER-AMES 3 cylinder vertical uniflow, 250 lbs. 0.8 lbs. back pressure.

125 KW CROCKER WHEELER-AMES 3 cylinder vertical uniflow, 250 lbs. 0.8 lbs. back pressure.



Actual Photograph

1000 KW ALLIS CHALMERS CONDENSING TURBO UNIT

1000 KW 80% P.F. 1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to 1000 KW Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

TURBO GENERATORS

3 Phase 60 Cycle

5000 KVA GENERAL ELECTRIC condensing, 150 lbs., with surface condenser; 6600 volts.

1250 KVA ALLIS CHALMERS condensing, 150-200 lbs., 500 deg. TT, with jet condenser; 2300 volts.

500 KVA WESTINGHOUSE non-condensing, 175 lbs. pressure, 0-5 lbs. back pressure; 2400 volts.

THE NATIONAL POWER

WER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers.

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformer.

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers.

1000 KW GENERAL ELECTRIC, 600 volts D.C. 900 RPM with 3 phase 60 cycle 24000 volt transformers.

1000 KW (2) WESTINGHOUSE, 600 volts D.C., 900 RPM with 3 phase 60 cycle 23000 volt transformers.

750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers.

500 KW (2) GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 13200 volt transformers.

300 KW WESTINGHOUSE, 250 volts D.C., 600 RPM with 3 phase 60 cycle 2300 volt transformers.

ROTARY CONVERTERS

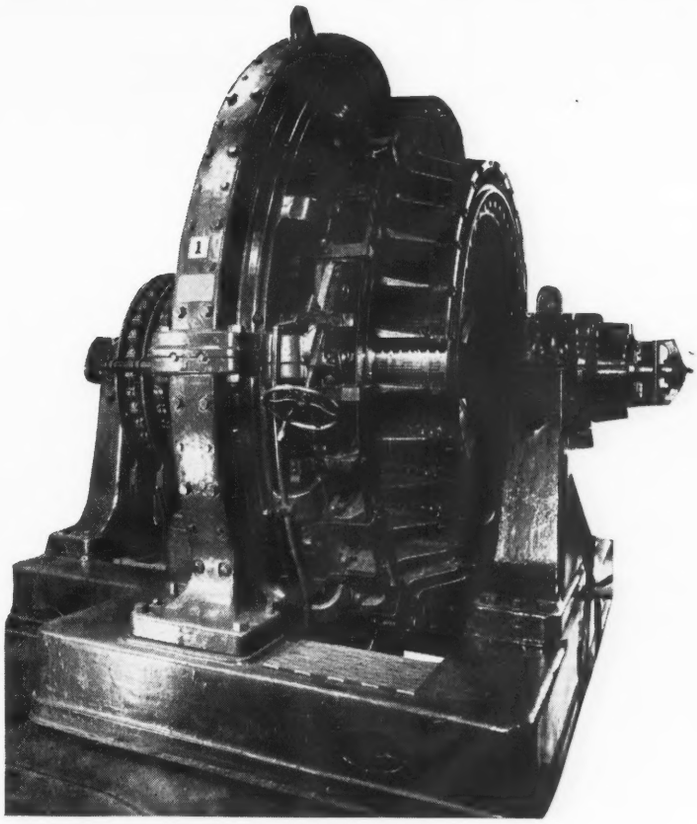
25 Cycle

2000 KW WESTINGHOUSE, 250-300 volts D.C., 300 RPM with 3 phase 25 cycle transformer any voltage.

2000 KW WESTINGHOUSE, 600 volts D.C. 375 RPM with 3 phase 25 cycle 11000 volt transformer.

1500 KW (3) WESTINGHOUSE, 600 volts D.C., 250 RPM with 3 phase 25 cycle 6600 volt transformers.

1000 KW GENERAL ELECTRIC, 250 volts D.C., 214 RPM with 3 phase 25 cycle 6600 volt transformer.



Actual Photograph

3500 KW WESTINGHOUSE ROTARY CONVERTER

3500 KW (2) Westinghouse booster type interpole rotary converters, 225-285 volts D.C. 225 RPM; 6 phase 60 cycle A.C. with 3 phase 60 cycle 13200 volt transformers. Complete with control.

Can be shown in operation

MOTOR GENERATOR SETS

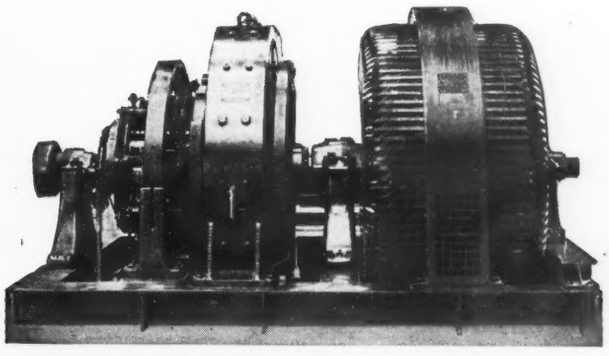
3 Phase 60 Cycle

1000 KW GENERAL ELECTRIC synchronous, 125-250 volts 3-wire D.C.; 3 phase 60 cycle 13200 volts A.C., 720 RPM.

750 KW GENERAL ELECTRIC synchronous, 600 volts D.C., 3 phase 60 cycle 2300 volts A.C., 720 RPM.

400 KW GENERAL ELECTRIC induction, 250 volts D.C., 3 phase 60 cycle 2200 volts A.C., 600 RPM.

150 KW WESTINGHOUSE synchronous, 250 volts D.C., 3 phase 60 cycle 2300 volts A.C., 900 RPM.



1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts, 3-wire, 720 RPM., direct connected to 1400 HP 80% P.F. General Electric synchronous motor, 3 phase 60 cycle 13200/6600 volts, 720 RPM. Equipped with D.C. breakers. Can be shown in operation.

R MACHINERY CO.

1921 SCRANTON RD.
CLEVELAND, OHIO

POWER PLANT MACHINERY

Available Immediate Delivery

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

2500 KVA ALLIS condensing 200 lb. pressure, 100° S.H., 600 volts, 3600 RPM complete with surface condenser.

1563 KVA WESTGH. condensing 200 lb. pressure, 100° SH, 2400 or 550 volts, 3600 RPM complete condenser and auxiliaries, switchboard and instruments.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with Ingersoll-Rand condenser, exciter, switchboard and instruments.

937 KVA (2) WESTINGHOUSE automatic extraction condensing, 150 to 200 lb. pressure, 10 lb. gauge back pressure, 480 volts, 3600 RPM, complete condensers, exciters, switchboards and instruments.

937 KVA ALLIS condensing 200 lb. pressure, 100° SH, 2300-550-480 volts, 3600 RPM complete surface condenser with auxiliaries, direct connected exciter—Modern and practically new.

937 KVA WESTINGHOUSE non-condensing, 175-200 lb. pressure, 10 lb. back pressure, 480 volts, 3600 RPM, complete motor driven exciter set, switchboard and instruments.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

375 KVA G.E. condensing 225 lb. pressure, 150° S.H., 2300 volts, 3600 RPM, complete direct connected exciter, Manistee jet condenser with auxiliaries.

112 KVA TERRY-ALLIS CHALMERS non-condensing 175-200 lb. pressure, 0.8 lb. back pressure, 480 volts, 3600 RPM, complete direct connected exciter, switchboard and instruments.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24"x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

500 KVA G.E. 240 volts, 120 RPM direct connected 20"x42" Rice Sargent Corliss non-condensing engine, 125-150 lb., 10 lb. back pressure.

438 KVA G.E. 240/480 volts, 150 RPM direct connected 24"x30" Chuse N.R.C. non-condensing engine, 125-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

Direct Current

1500 KW WESTINGHOUSE 250 volts, 360 RPM generator direct connected by reduction gear to a Westinghouse condensing turbo generator unit complete with auxiliaries.

500 KW CROCKER WHEELER 250 Volts, 300 RPM direct connected Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 6 lb. gauge back pressure, complete switchboard and instruments.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

200 KW G.E., 125 volt, 200 RPM direct connected 18"x24" Erie Ball non-condensing engine, 135-150 lb. pressure.

100 KW GENERAL ELECTRIC, 125 volts, 250 RPM direct connected Skinner Universal Unaflow non-condensing engine, complete switchboard and instruments.

65 KW GENERAL ELECTRIC 125 volt, 1100 RPM, direct connected Terry non-condensing turbine, 125-150 lb., 5 lb. gauge back pressure.

50 KW WESTINGHOUSE 125 volt, 1750 RPM, direct connected Westinghouse non-condensing turbine, 225 lb. pressure, 150° F-SH, 3 lb. back pressure.

20 KW G.E. 125 volt, 4500 RPM, 175 lb. pressure non-condensing turbine-generator unit.

MOTOR GENERATOR SETS

1500 KW ALLIS 600 volt direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM synchronous motor.

1000 KW G.E. 575 volts direct current generator direct connected 1430 HP, 3 phase, 60 cycle, 4000 volt, 514 RPM synchronous motor.

750 KW G.E. 550 or 275 volt, direct current generator direct connected 1075 HP 90% P.F., 3 phase, 60 cycle, 4000 volt, 514 RPM synchronous motor.

175 KW (2) General Electric, 125 volt, type MPC, interpole, direct current generators each direct connected to a 260 HP 90% P.F., type TS, 3 phase, 60 cycle, 220 volt, 1200 RPM, synchronous motor — complete switchboard panels and instruments.

75 KW, General Electric, 125 volt, direct current generator direct connected to a 112 HP, 3 phase, 60 cycle, 440 volt, 1200 RPM Electric Machinery Company synchronous motor, complete with switchboard and instruments.

20 KW G.E. 125 volts direct current generator direct connected 25 HP, 3 phase, 60 cycle, 220 volts, 1200 RPM motor.

MOTORS

3 phase, 60 cycle

800 HP, WESTGH. 440 V., 240 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

400 HP, G.E. type TS, Form AL, 440 V. 300 RPM synchronous.

400 HP, WESTINGHOUSE type CW, 440 V., 500 RPM, slip ring.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

250 HP, ALLIS-CHALMERS 440 V., 600 RPM synchronous.

125 HP, (3) 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

75 HP, E.M. CO. 2300 V., 1200 RPM slip ring.

50 HP, type I, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP, (2) G.E. form K, 220 V., 900 RPM squirrel cage.

22 HP, G.E. type ITC, 440 V., 1200/600 RPM, slip ring.

MISCELLANEOUS

1 WESTINGHOUSE frequency changer set consisting of a 655 HP, 3 phase, 25 cycle, 2200 volt, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt alternating current generator complete and equipped with direct connected exciters, all panels with instruments—practically new.

250 KW CROCKER-WHEELER 250 volt, 600 RPM compound wound interpole direct current generator.

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

150 KVA G.E. 3 phase, 60 cycle, 440 volt, 900 RPM belted alternator.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

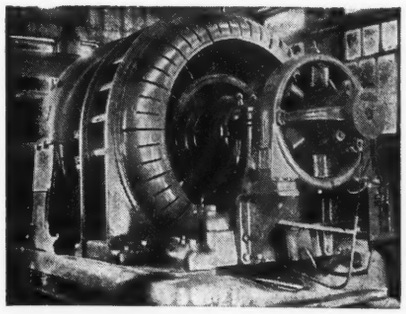
1500 sq. ft. WESTINGHOUSE surface condenser.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO
WIRE OR PHONE
LONG DISTANCE 422

AVOID DELAY...

Step up your Power



MOTOR GENERATOR SETS

1—500 KW, 125/250 volt, 3-unit, General Elec., synchronous.
1—500 KW, 650 volt, General Electric, syn.
1—300 KW, 250 volt, General Electric, syn.
1—100 KW, 125 volt, Westinghouse, syn.
1—75 KW, 250 volt, synchronous.
1—100 KW, 125/250 volt, Allis Chalmers, squirrel cage.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—25 KW, 125 volt, General Electric, syn.
1—20 KW, 125 volt, Burke, squirrel cage

D. C. GENERATORS

1—100 KW, 750 RPM, 125 volt, West. Elec.
1—100 KW, 600 RPM, 125/250 volt, G.E.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—67½ KW, 700 RPM, 45 volt, Gen. Elec.
2—32 KW, 650 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—250 HP, 450 RPM, 220 volt, G.E., slip ring.
1—250 HP, 360 RPM, 440 volt, Westg. sq. cg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—200 HP, 514 RPM, 4000 volt, G.E., syn.
1—175 HP, 900 RPM, 440 volt, Westg. syn.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 HP. 900 RPM, 440 volt, Allis Chal. sl. rg.
2—150 HP, 720 RPM, 220 v., Elec. Mach. syn.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 1800 RPM, 440 v., Allis Chal. sq. cg.
1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.
1—75 HP, 1800 RPM, 220/440 v., G. E., sq. cg.
1—75 HP, 900 RPM, 4000 v., Elec. Mach. syn.
1—75 HP, 900 RPM, 440 volt, G.E., enclosed, fan cooled, squirrel cage.
1—75 HP, 900 RPM, 220 volt, Fairbanks-Morse, slip ring.
1—75 HP, 900 RPM, 2200 volt, G.E., slip ring.
1—75 HP, 514 RPM, 440 volt, G.E., sq. cg.
1—60 HP, 1750 RPM, 220 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

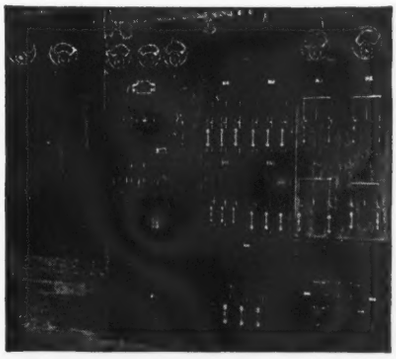
1—125 HP, 850 RPM, G.E., type CD.
1—125 HP, 550 RPM, General Electric.
1—100 HP, 1600 RPM, West., type SK.
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 1750 RPM, Westinghouse, type SK.
1—50 HP, 1100 RPM, Crocker Wheeler.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, 725 RPM, Westinghouse, type SK.

OIL CIRCUIT BREAKERS

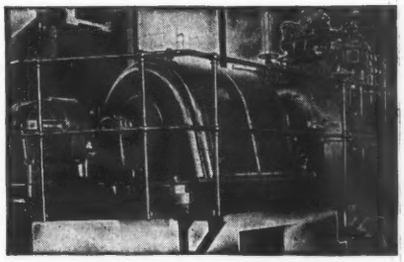
2—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
2—2000 amp., 15,000 v., 3 pole, G.E., type FK-53b.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1500 amp., 440 v., 3 pole, Condit, D12.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 240 RPM, 2300 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—100 KVA, 1200 RPM, 440 volt, G.E.
1—37½ KVA, 1200 RPM, 2400 volt, Westg.
1—15 KVA, 1800 RPM, 120 volts, G.E.



Switchboard Panel built by us for Synchronous Motor Generator Set



TRANSFORMERS

1—15,000 KVA, Pitts., 3 ph., 26,000/4150 v.
4—833 KVA, Allis Chal., 25 cy., 13,200/440 v.
3—400 KVA, Moloney, 13,800-220/440 volts.
2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—300 KVA, Pittsburgh, 4600-115/230 volts.
4—200 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000-2300/4000 Y.
3—150 KVA, Pittsburgh, 6600/440 volts.
12—150 KVA, G.E., 3 ph., 4150-120/208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, G.E., 2400-240/480 volts.
3—100 KVA, Wagner, 2300-240/120 volts.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
3—50 KVA, Westinghouse, 2200-220/110 volts.
4—50 KVA, Westg., air cooled, 440-220/220-110 v.
3—50 KVA, Westinghouse, 220-110/220 volts.
3—50 KVA, G.E., 2200-110/220 volts.
52—37½ KVA, 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
12—15 KVA, Westg., air cooled, 440/220-220-110 v.
4—10 KVA, G. E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

TURBO-GENERATORS

2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—625 KVA, Westinghouse, non-condensing.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—150 KW, 125/250 volt, Westg., non-cond.
1—100 KW, 125 volt, Westg., non-cond.
1—25 KW, 125 volt, Ridgeway, non-cond.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—75 HP, 235/950 RPM, Burke.
1—60 HP, 600/1200 RPM, General Electric.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—20 HP, 750/1500 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.
1—5 HP, 600/1800 RPM, General Electric.
1—3 HP, 500/2000 RPM, Westinghouse.

J. L. HEMPHILL & CO., INC., Power Equipment

New York Phone: LOngacre 5-3227 — 1602 53rd ST., NORTH BERGEN, N. J. — New Jersey Phone: PAlisade 6-2600

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—7500 KVA General Electric Cond.
1—2850 KVA Westinghouse Cond.
1—2500 KVA General Electric Cond.
1—1563 KVA General Electric Cond.
1—1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
3— 625 KVA General Electric Cond.
1— 625 KVA General Electric Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
2— 156 KVA Allis Chalmers Non-C
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1—1000 KVA Skinner Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 425 KVA Hamilton Poppet Valve
1— 325 KVA Skinner Uniflow
1— 250 KVA Skinner Uniflow
1— 250 KVA Harrisburg Uniflow
1— 240 KVA Hamilton Corliss

DC STEAM ENGINE UNITS

1—500 KW Skinner Uniflow 250 V.
1—400 KW Mesta Uniflow 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Chuse 4-valve 250 V.
2—250 KW Skinner Uniflow 250 V.
1—200 KW Chuse 4-valve 250 V.
2—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125/250 V. vertical
1—125 KW Ames Uniflow 125/250 V. vertical
1—100 KW Ames Uniflow 120 V.
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—1750 KVA Mesta (gas) 2300 V.
2—1000 KVA Mesta (gas) 2300 V.
1—1000 KVA Nelseco Diesel 2300 V.
1— 603 KVA Fair.-Morse 480 V.
1— 375 KVA Cooper-Bess. 2300 V.
1— 375 KVA Ing.-Rand 2300/440/220 V.
1— 237 KVA Fair.-Morse 480 V.
1— 210 KVA Natl. Superior 440/220 V.
1— 200 KVA Fair.-Morse 2400/440/220 V.
1— 100 KVA Buckeye 240/480 V.

WATER TUBE BOILERS

2—520 HP Heine 200-lb. Hand Fired
1—512 HP Erie City 175-lb. Oil Burner
2—511 HP Union 200-lb. Stokers
1—500 HP B. & W. 200-lb. Stoker
2—407 HP Erie City 250-lb. Stokers
1—389 HP Stirling 200-lb. Stoker
2—357 HP Casey-Hedges 175-lb. Stokers
1—325 HP Stirling 160-lb. Stoker
2—282 HP Edge Moor 200-lb. Stokers
2—254 HP Stirling 180-lb. Stokers
2—160 HP Stirling 155-lb. Hand Fired.

SYNCHRONOUS CONDENSERS

1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1—500 KVA West. 2200 V. 900 RPM

SYNCHRONOUS MOTORS—60 Cy.

2—800 HP Electric Machy. 6600 V. 450 RPM
1—500 HP General Electric 440 V. 360 RPM
1—225 HP General Electric 2200 V. 225 RPM
2—200 HP General Electric 440 V. 277 RPM
1—175 HP General Electric 440 V. 277 RPM
1—100 HP General Electric 440 V. 277 RPM

OIL CIRCUIT BREAKERS

1—800 A. 87 KV Am.Br.Bov. AF22 Outdr.
5—600 A. 30 KV Kelman CB-76 Outdoor
1—400 A. 25 KV G. E. FK0136 Outdoor
4—400 A. 25 KV Conduit D-16-A Outdoor

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA West. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
2— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/60 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.

2—1000 KW General Electric, 600 V.
1— 750 KW General Electric, 250 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

TRANSFORMERS—1 Ph. 60 Cy.

3— 600 KVA West. 120,000/2300 V.
3— 1667 KVA G. E. 6600/22000 V.
2— 1000 KVA West. 66000/2300 V.
3— 333 KVA Pitts. 44000/2300 V.
3— 500 KVA Allis 33000/480 V.
2— 1000 KVA G. E. 23000-11500/575 V.
3— 100 KVA G. E. 22000/6900 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
5— 1000 KVA G. E. 13800/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
4— 200 KVA West. 13200/2300-4000 V.
3— 150 KVA Pitts. 13800/230-60 V.
3— 75 KVA West. 13800/230-460 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3— 75 KVA G. E. 11000-9900/244-488 V.
2— 3300 KVA G.E. 6600/110 V. 3 ph. Furnace
3— 1250 KVA G. E. 6600/550 V.
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3—1500 KVA West. 2300/106 V. 3 ph. Furnace
3—1000 KVA Pitts. 2300-4600/550 V.
3— 75 KVA Wagner 2300/230-460 V.
6— 50 KVA G. E. 2400/240-120 V.
3— 50 KVA Wagner 2400/480-240 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & Co., INC.

50 CHURCH STREET, NEW YORK CITY

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

AC TURBINE UNITS

1250 KVA G. E. 2300/4000 v., 600° TT.; Cond.
937 KVA Al. Chal. 2300 v., 550° TT.; Cond.
937 KVA G. E. 2300 V., 500° TT.; Cond.
937 KVA Al. Chal.-Elliot 480 V., 500° TT. Cond.
937 KVA G. E. 2300 V. Automatic Extraction, 500° TT.; Cond.
780 KVA Al. Chal.-Terry 600 V., Automatic Extraction, 500° TT.; Cond.
780 KVA Wghse. 2400 V., 500° TT.; Cond.
625 KVA G. E. 2300 V., 500° TT.; Cond.
625 KVA Al. Chal.-Elliot 440/220 V., Automatic Extraction, 500° TT.
625 KVA Wghse. 2300 V., 500° TT., *Non-Cond.*
375 KVA G. E. 2300 V., 500° TT.; with Cond.
375 KVA G. E. 2300 V., 500° TT.; *Non-Cond.*
312 KVA Ridgeway-Elliot, 480 V., 500° TT. Cond.
150 KVA Wghse. 240/480 V., 500° TT.; Cond.
125 KVA Wghse. 240/480 V., 500° TT.; *Non-Cond.*; 25 to 60 lbs. b.p.

DIRECT CURRENT UNITS

KW	GEN.	VOLTS	ENGINE
1000	Al. Chal.	250	Al. Chal.
600	G. E.	250	Corliss
300	G. E.	250	Skinner Unif.
300	Wghse.	250	Murray Corliss
200	Wghse.	250	Turbine
200	G. E.	125	Erie Ball 4 V.
150	G. E.	250	Skinner Unif.
100	C. W.	250	Erie Ball 4 V.
100	G. E.	125	Erie Ball 4V.

A.C. UNITS

450 KVA Wghse.—18x36 Filer Stowell Corliss
375 KVA G.E.—22x27 Erie Ball 4 V.
312 KVA G.E.—20x30 Fitchburg 4 V.
312 KVA Elec. Machy—20x24 Chuse Uniflow
312 KVA Wghse.—21x22 Skinner Uniflow
300 KVA G.E.—18x36 Murray Corliss
300 KVA G.E.—Murray Uniflow
250 KVA G.E.—18x42 Hewes-Phillips Corliss
250 KVA G.E.—17x20 Erie Ball, 4 V.
200 KVA G.E.—21x22 Skinner Uniflow
200 KVA Al. Chal.—14x36 Al. Chal. Corliss
125 KVA G.E.—14x15 Skinner Uniflow
112 KVA G.E.—14x18 Erie Ball 4 V.
100 KVA G.E.—14x16 Skinner Uniflow
60 KVA G.E.—12x12 Skinner Uniflow

BOILERS (ASME)

728 HP E.C. Vert. 200#
600 HP (4) B & W 200#
502 HP (2) Edgemoor (Heine) 225# "Nation-Board." Practically new.
500 HP Murray (Heine) 200#
484 HP Springfield Cross drum, 200#
471 HP Erie City vert, 200#
420 Sterling, 200#
407 HP (2) Erie City bent tube, 250# "National Board"
389 HP Sterling 200#. "National Board".
340 HP (2) Brunswick Kroeschell, cross drum, box header. 165# "National Board."
320 HP Sterling, 200# With Detroit Underfeed stokers.
300 HP (2) B & W 160#
300 HP Heine 175#
295 HP (3) Sterling, 200#
253 HP Cumbustion Engr. Co. 165#. "National Board"; practically new with Detroit Roto-stoker
200 HP Combustion Engr.; HRT 150#

PUMPS (Motor Driven)

17250 GPM Alberger 40' head
4000 GPM DeLaval 195' head
2000 GPM Worthington 290' head
1600 GPM Al. Chal. 216' head
1500 GPM DeLaval 290' head
1000 GPM Morris 255' head
850 GPM Al. Chal. 243' head
600 GPM Al. Chal. 450' head

ROTARYS

1500 KW Wghse. 600 V.—3 ph., 60 cy.
1000 KW G.E. 600 V.—3 ph., 60 cy.
500 KW G.E. 600 V.—3 ph., 60 cy.
400 KW (2) G.E. 250 V.—3 ph., 60 cy.
300 KW G.E. 600 V.—3 ph., 60 cy.
100 KW G.E. 275 V.—3 ph., 60 cy.

FREQUENCY CHANGERS

625 KVA Wghse. 60—25 cycles
625 KVA G.E. 25—60 cycles

TRANSFORMERS

2—687 KVA Maloney 2200/220 V.
2—500 KVA Maloney 13,800/480 V.
3—100 KVA Al. Chal. 22,000/440 V.
3— 75 KVA Wghse. 2300/575 V.

STEAM LOCOMOTIVE

American, 70 tons with tender Standard G

COMPRESSORS

1300 CFM Ingersoll-Rand 100 lbs, with 200 HP G.E., 3-60-440 V. motor
1000 CFM Ingersoll-Rand 3 lbs, with 100 HP A.C. motor

SURFACE CONDENSORS

3100 Sq. Ft Wheeler
2000 Sq. Ft. Wheeler
1200 Sq. Ft. Worthington

HEATERS

All sizes and types

ENGINES (belted)

TWIN ENGINE: 22x36 Nordberg Uniflow
20x21 Skinner Uniflow (15-20 lbs. b.p.)
16x16 Ames Uniflow

GAS & DIESEL UNITS

1000 KVA Al. Chal. 3 ph., 60 cy., with Worthington nat. gas engine
1000 KVA G.E. 3 ph., 60 cy., with Cooper Bessemer nat. gas engine
200 KVA G.E. 3 ph., 60 cy., Busch Sulzer Diesel
168 KVA Ideal 3 ph., 60 cy., with Fulton 3 cyl. Diesel Engine; dir. con. exciter

TURBOS 60 cy

1—4000 KW GE 7-stage double bucketed 60/3/6600/1800 RPM 150/200# ISP. Surface Condenser, exciter and pasels.

1—3125 KVA Lynn Type GE Rigid Frame 4-stage 60/3/2300/3600 RPM. Surface Condenser equipped. Unique minimum log service.

1—1000 KW 80% PF GE Curtis Form B 60/3/4800 Y connected /3600 RPM. Turbo 4-stage 225# 200° Superheat condition. Has recently operated NC at full load 15# Gauge. Self-contained exciter, no condenser available. Unit reported like new.

1—625 KVA Wemco 10-C Parsons or NC 60/3/440/2200/3600—Jet Condenser—Surface available.

1—300 KW Wemco Single Wheel Re-entry 6-/3/240-120/250#.

TURBOS 25 cy

6250 KW 80% PF Parsons design Multiple Expansion Parallel Flow 25/3/4000/1500 RPM, Surface Condenser equipped.

6000 KW GE Curtis 25/3/6600/1500 RPM, Jet Condenser equipped.

2—7200 KVA Wemco Impulse and Reaction Semi-Double Flow 25/3/11000/1500 RPM. Surface Condenser equipped.

3—4000 KW 80% old rated (log service record 7500 KW) Wemco Impulse anl Reaction design 25/3/13200/1500 RPM. Surface Condenser equipped.

2—3500 KW Wemco 25/3/13200/1500 RPM with combined 18000 sq. ft. Surface Condenser.

TURBOS DC

1—1000 W Wemco 250 volt Generator geared at 514 RPM to Wemco 3600 RPM Condensing Turbo.

1—500 KW GE Mixed Pressure 16 to 140# 250 volts DC. Surface Condenser 3100 sq. ft.

MOTOR GENERATORS

1—1500 KW GE MPC 60/3/4000 to: 600 volts DC.

BOILERS

2/1000 HP Edgemoor ASME identified 200# Box Steel Header Straight Tube Water Tube Boilers, oil-fired, practically brand new, one never operated; one operated few months only on experimental program.

3—833 HP B&W Stirling ASME Boilers 200#. Wemco Underfeed Stokers.

9—600 HP B&W Vertical Steel Header Longitudinal 3-drum 200# Superheater and Taylor Stokers.

2—525 HP Springfield Cross Drum Sectional Header ASME Water Tube Boilers 225#. Superheaters and Chain Grates.

3—500 HP Egdemoor Steel Header Boilers—200#—Foster Superheaters.

2—484 HP Springfield Horiz. ASME Straight Tube Longitudinal Cross Drum Boilers, one 200#, the other 225# and with Wemco Stoker.

1—389 HP B&W Stirling Water Tube ASME and Hartford—200#. Stokers and all auxiliaries.

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	300	Cr. Wh.	CCM-108H	550
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G.E.	LC-50	1200
1—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	500	G.E.	MPC	675/900
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
2—	275	G.E.	DMC	500/750
1—	200	Whse.		400/500
1—	150	G.E.	MPC	250/450
2—	100	G.E.	C	480/1100
1—	100	Al.Ch.		950/1150
3—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr.Wh.	65H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El.Dy.	S	525/1050
2—	50	Cr.Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
1—	30	Whse.	SK	575/1150
1—	25	Cr.Wh.	50H	335/1000

TRANSFORMERS

	KVA	Make	Ph.	Type	Voltages
3—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
3—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	HKDD	13800x575
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

ENGINE GENERATOR SET

1—100 KW, Whse. D.C. Gen. 125/250 v. 3 wire 250 R.P.M. dir. Conn. 150 H.P., 14x15 Skinner steam engine 150# press

MOTOR GENERATOR SETS

3 phase—60 cycles

2—1500 KW G.E. 600 v. Gen d.c. to 2100 HP 6600 v. syn. motor

1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 13200 v. syn. motor

1—500 KW G.E. 600 v. Gen d.c. to 700 HP 2300 v. syn. motor

1—400 KW, G.E. 250 v. Gen. to 600 HP 2300 v. syn. motor.

1—300 KW G.E. 600 v. Gen d.c. to 435 HP 10000 v. syn. motor

1—250 KW G.E. 275 v. Gen d.c. to 350 HP 4600 v. syn. motor

1—200 KW Al. Ch. 3 units; 2—100 KW 250 v., Gen. d.c. to 220 KVA 2200 v. syn. motor.

TURBO GENERATOR SET

1—500 KW, Whse., 625 KVA, 480 v., 3 ph., 60 cy. generator with Curtis single stage 160/125 pound non-condensing turbine good for 5 to 10 pounds back pressure

1—500 KW, G.E., 625 KVA, 2300 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3-single phase, 33000 v. transformers and panel

1—1500 KW Whse 720 RPM 600 v. DC with 1- three phase 11500 v. transformers and panels

2—1000 KW whse. 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels.

2—1000 KW, G.E. HCC 900 RPM 600 v. DC with 1-three phase, 11000 v. transformer and panels

1—750 KW Whse 720 RPM 250 v. DC with three phase 6600/2300 v. transformer and panels.

1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels

1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600, V, AC, 6 ph., 1200 RPM.

A C MOTORS

3 phase—60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	2150	G.E.	ATI	2200	360
1—	2000	G.E.	ATI	2300	450
1—	500	G.E.	TS	440	360
1—	350	Cr.Wh.	301	2200	600
1—	300	G.E.	ATI	440	600
1—	300	G.E.	ATI	2300	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220x440	450
1—	150	Whse.		2200/550	1800
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	G	2300	900

Slip Ring

1—	1000	G.E.	IM	2200	720
2—	600	G.E.	IM	2200	900
3—	500	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al.Ch.		2300	505
1—	300	Al.Ch.	ANY	2200	585
2—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	Whse.	CW	440	585
1—	250	G.E.	MT	4000/2300	257
1—	250	F.M.	BV	2200	1200
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	435
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM	2200	695

Squirrel Cage

1—	500	G.E.	1-17B	2200	690
1—	400	G.E.	KT	2300	585
1—	300	Whse.	CS	550	580
2—	300	G.E.	IK	2300	600
1—	250	Al.Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
1—	150	G.E.	IK	2200/440	900
3—	150	Al.Ch.	AN	220/440	1750

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

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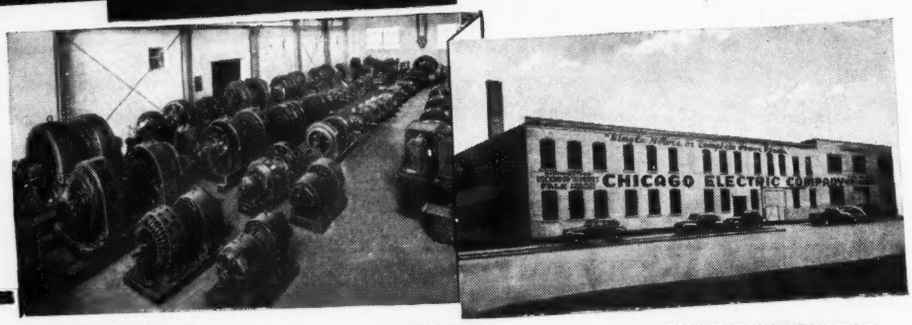

MOTOR-GENERATOR SETS

500 KW GE MCF 550 v DC
1050 HP 3/60/440 syn.
500 KW GEMPC 550 v. DC
720 HP 3/60/4400/2200
235 KW Wtg. 118 v. DC
360 HP 3/60/2200 v. syn.
225 KW Ideal 115 v. DC
325 HP 3/60/2200 syn.
300 KW GE MP 3-unit
125/250 DC 4400/2200 AC
300 KW GE MPC 600 v. DC
435 HP 3/60/1100/2200
150 KW GE 250 v. DC
225 HP 3/60/2300/440 AC
150 KW GE C-75 250 v. DC
3/60/2200/440 syn El.M.
100 KW Wtg SK 250 v. DC
3/60/2200 syn 900 RPM
100 KW Wtg. SK 250 v. DC
3/60/2200 ind. 900 RPM
100 KW Wtg SK 250/125 DC
3/60/220 ind. AC 1200 RPM
2-50 KW Wtg SK 250/125 v. DC
3/60/220 ind. AC 1200 RPM
90 HP Wtg. SK 110 v. DC
75 KVA 3/60/2300 AC 900.

SQUIRREL CAGE

HP	Make	Volts	Speed
200	G.E.	440	580
200	Wtg.	440	580
150	Wtg.	2200	1175
150	Al. Ch.	440	1170
125	G.E.	220	1800
125	Cr. Wh.	440	880
125	G.E.	2300	580
100	Wtg. (2)	440	1200
100	G.E.	220	1200
100	G.E.	440	900
75	G.E.	2200	1760
60	G.E.	220	900
60	Wtg.	220	435

SYNCHRONOUS

HP	Make	Volts	Speed
1050	G.E.	460	500
750	Wtg. (2)	2300	1200
650	Al. Ch.	2300	1200
450	Wtg. (2)	2300	1200
225	G.E.	240	720
200	El. My.	2200	1200
200	Wtg.	2200	225
190	El. My.	440(2)	720
190	El. My.	220(2)	514
75	El. My.	220	1200

SLIPRING

HP	Make	Volts	Speed
600	G.E.(2)	2200	1770
500	G.E.(2)	2200	600
350	Al. Ch.	2200	300
300	G.E.	4000/2300	514
350	G.E.	2300	300
250	G.E.	2200	1175
250	G.E.	220	450
225	G.E.	440	600
200	G.E.(2)	440	600
200	Howell (has roller bearings)	440	600
200	West.	440	580
200	Wtg.	440	345

BOILER FEED PUMP

1—Worthington size 12" x 7½" x 15", 300# water press.
175# steam press. duplex plunger type.

PUMP

800 G.P.M. 325 ft. hd.
American, 3-stage, with 100 HP Wtg. CS 3/60/2300/4600 v. 1200 RPM motor.

ENGINE-GENERATOR

800 KW G.E. type ATB 3/60/480 Skinner unaflow, hor. condsg.

FREQUENCY CHANGERS

90 KW GE adjustable, 60 HP 3/60/220 4-speed mtr. 60/120, 60/100, 60/90 and 60/80 cy.
500 KVA Wtg. 583 HP 3/25/2300/575/440/220 750 RPM syn. motor
500 KVA 3/62½/2300/440/220 syn. gen. both with amortg. weg.

SYNCHRONOUS CONDENSER

1000 KVA Wtg 3/60/440 900
500 KVA Wtg 3/60/2300 900

DC GENS.

KW	Make	Volts	Speed
800	Elliott	250	720
500	G.E.	550	900
200	Elliott	115	900
200	Morg. G.	230	550
160	Cr. Wh.	3-wire	160
150	Wtg.	250	875
150	G.E.	C7	1200
150	Morg. G.	230	550

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ELECTRICAL EQUIPMENT

FOR IMMEDIATE DELIVERY

SUBJECT TO PRIOR SALE

ROTARY CONVERTERS

2—**ROTARY CONVERTERS** — 400 KW, Westinghouse, 720 RPM, D. C. E. M. F. 3 phase, 550/600 volts, from 440 volts A.C. Complete with 175 KVA Transformers, G.E., 60 cycle, 60,000—54,000—440/401 volts, oil cooled.
1—**ROTARY CONVERTER**—500 KW, G.E., 1200 RPM, D. C., 600 volts, 60 cycle, Form P, from 440 volts. Complete with 175 KVA Transformers, G. E., 60 cycle, 60,000—54,000—440/401 volts, air cooled.
1—**ROTARY CONVERTER** — 500 KW, G.E., 720 RPM, D.C., 650 volts, 60 cycle, Form P, from 440 volts. Complete with 165 KVA Transformers, G.E., 60 cycle, 60,000—54,000—466 volts, oil cooled.

LOCOMOTIVES

4—**LOCOMOTIVES**, Road, 600 volt, A. C.—D.C. Westinghouse, Series 600, 38" driver wheels, weight on drivers—50 tons.
5—**LOCOMOTIVES**, Road, 600 volt, A. C.—D. C., Westinghouse, Series 700, 50" driver wheels, weight on drivers—73.6 tons. Each Locomotive has a Transformer built-in, cutting the voltage down from 6600 to 600. Motors are Universal.
1—**LOCOMOTIVE**, Switching, 600 volt, D. C., Westinghouse, Series 500, 36" driver wheels, weight on drivers—50 tons.
1—**LOCOMOTIVE**, Road, 600 volt, D. C., Westinghouse, Series 500, 36" driver wheels, weight on drivers—50 tons.
2—**LOCOMOTIVES**, Road, 600 volt, D.C., Westinghouse, Series 500, 33" driver wheels, weight on drivers—48 tons. These two Locomotives can be operated in parallel as one unit.

MOTOR-GENERATOR SETS

3—**MOTOR-GENERATOR SETS**—50 KW, 125 volts.
1—**MOTOR-GENERATOR SET**—Generator: 750 Kw, 650 volts, 1155 amps., 500 RPM, Westinghouse, Serial #991710. Motor: 1020 HP, Induction, three phase, 60 cycle, 2200 volts, Westinghouse, Constant Speed, Type HF, 500 RPM 70.6 amps.

TRANSFORMERS

4—**TRANSFORMERS**, 1000 KW, 60000 to 4000 volt, Westinghouse, 60 cycle.
5—**TRANSFORMERS**, 1250 KW, 45000 to 2200 volt, Westinghouse, 25 cycle.
3—**TRANSFORMERS**, 375 KW, 6600 to 2200 volt, Westinghouse, 60 cycle.
24—**TRANSFORMERS**, 375 KW, 45000 to 6600 volt, Westinghouse, 25 cycle.
3—**TRANSFORMERS** 300 KVA, 60000 to 2200 volt, Westinghouse, 60 cycle.
12—**TRANSFORMERS**, 175 KVA, 60000 to 440 volt, General Electric, 60 cycle.
3—**TRANSFORMERS**, 75 KW, 4000 to 440 volt, Westinghouse, 60 cycle.
1—**TRANSFORMER**, 50 KW, 4000 to 440 volt, Westinghouse, 60 cycle.
1—**TRANSFORMER**, 60 KW, Light
1—**TRANSFORMER** 25 KW, Light.

ELECTRIC WIRE

TRANSMISSION

257 miles—#2 Hard drawn Copper, bare.

TROLLEY

100 miles—3/0 Copper, bare.
90 miles—4/0 Copper, bare.

DISTRIBUTION

185 miles—4/0 Copper, bare.
3 miles—500,000 CM, Copper, bare.

FREQUENCY CHANGERS

4—1000 KW, FREQUENCY CHANGERS:—1000 or 1500 HP Westinghouse Motors, 4000 volt, 3 phase, 60 cycle, 500 RPM, direct connected to 2200 volt Generators, 1000 KW, single phase, 25 cycle, 500 RPM.

FOR PRICES, FURTHER INFORMATION, ETC., WRITE, WIRE OR PHONE

DULIEN STEEL PRODUCTS, INC.

OF WASHINGTON

414 First Avenue South - - - Seattle, Washington

LOS ANGELES — SAN FRANCISCO — PORTLAND — BUTTE — NEW YORK — NEW ORLEANS

REBUILT POWER EQUIPMENT—Ready to Ship

ROTARY CONVERTERS

100 kw., G.E. 250 v. 1200 rpm., 2200/4000 v. 3 ph. 60 cy.
150 kw., West. 250 v. 1200 rpm., 2200 3 ph. 60 cy.
150 kva. G.E. 250 v. 1200 rpm., 440/3/60 type HCC.

MOTOR GENERATOR SETS

110 kw. Crocker Wheeler 250 v. 720 rpm., 2200/3/60 ind.
150 kw. Crocker Wheeler 250 v. 550 rpm., 2200/440/220 v. SYN.
150 kw. Crocker Wheeler 250 v. 600 rpm., 220/440 v. ind.
150 kw. Crocker Wheeler 250 v. 600 rpm., 220/440 v. syn.

ENGINE GENERATOR SETS

50 kw. West. 220/3/60 Ames Auto. Steam.
75 kw. G.E. 250 D.C. Skinner Uni. Steam.
100 kw. Fair Morse 2400/3/60 belted 2 cyl. DIESEL.
175 kw. G.E. 2200/3/60 dir. con. Ridg. STEAM.
175 kw. West. 2200/2/60 dir. con. Skinner Steam.
200 kva. Fair Morse 2400/3/60 dir. con. 4 cyl. DIESEL.
225 kw. Elec. Machy. 2300/3/60 Ideal 4 valve Steam.
300 kw. West. 250 v. D.C. Skinner Uniflow Steam.

D.C. GENERATORS—250 volt

30 kw. Allis Chal. 700 rpm.
80 kw. West. 265 rpm.
100 kw. G.E. 550 rpm.
150 kw. Crocker Wheeler 550 rpm.

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm, 80% P.F. (Can be reconnected 440 or 220 v.)
150 kva. Wagner 220/440 v. 3 ph. 60 cy. 600 rpm.
125 kva. West. 2300/3/60 900 rpm.
75 kw. G.E. 240/3/60 900 rpm. 80% P.F.

SPECIALS IN SLIPRING MOTORS 3ph. 60 cy.

HP	Make	Speed	Type
700	G.E.	393	MT-432
400	West.	1170	CW
300	G.E.	600	M
260	Burke	600	EM-65
250	G.E.	590	I-174
200	West.	690	CW-956A
100	West.	1750	CI

SYNCHRONOUS MOTOR

225 HP. G.E. 2200 v. 3 ph. 60 cy. 80% P.F. 200 rpm. (Can reconnect 440 or 220 v.)

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake, 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

A.C. MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
800	2200	West.	Syn.	450
200	2200	G.E.	IK-15	1200
200	220/440	West.	CS	1200
200	220/440	West.	CS	720
200	220/440	West.	CS	600
225	2200	West.	CS	900
250	220/440	West.	CS	900
250	2200	West.	CS	1200
300	220/440	West.	CS	1150
300	2300	West.	CS	1200
300	2200/440/220	West.	CS	450
350	2200/440/220	West.	CS	450
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
500	2200/440/220	West.	CS	720
600	2200/440/220	West.	CS	900

CRANE MOTORS—230 V. D.C.

15 hp. Crocker Wheeler with electric brake 270 rpm
30 hp. Niles 650 rpm.
30 hp. Niles.
50 hp. West—38 B., 500 rpm.

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SPEED REDUCERS

23—3 to 5 HP. Thomas 2 speed ratio 1 side 100 to 1 other side 5 to 1.
5—10 HP. 600 At Cleveland ratio 90:1.
1—150 HP. R.D. Nuttal ratio 1.6:1.

TRANSFORMERS—1 ph. 60 cy.

1—100 kva. West. 2200-220/110.
2—75 kva. Burke 2200-110 v. 3 ph.
1—50 kva. Burke 2200-110 v. 3 ph.
2—50 kva. G.E. 2200-220/440 v.
3—37½ kva. West. 22000-2200.
6—10 kva. Pgh. 2200-220/110.

15 TON NILES CRANE—230 V. D.C.

31' span, lift 45 to 50', 3 motors. Practically New.

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

Get what you want IN A HURRY

from L. J. LAND & COMPANY, New York's Largest Stock of Electrical Equipment

A.C. EQUIPMENT

SYNCH. MOTORS

200 H.P. G.E. TS 514 RPM
90 H.P. Westinghouse 900 RPM
50 H.P. Elec. Mchy. 1200 RPM

SLIPRING MOTORS

300 H.P. General Electric 720 RPM
200 H.P. General Electric 514 RPM
150 H.P. Allis Chalmers 720 RPM
2—125 H.P. G.E. 720 RPM
112 H.P. G.E. hoist 720 RPM
100 H.P. Fairbanks Morse 720 RPM
100 H.P. Allis Chalmers 720 RPM
100 H.P. Westinghouse 720 RPM
75 H.P. Westinghouse 1200 RPM
75 H.P. Allis Chalmers 600 RPM
60 H.P. Westinghouse 1200 RPM
60 H.P. General Electric 1200 RPM
60 H.P. General Electric 900 RPM
6 H.P. Westinghouse 300 RPM
4 H.P. GE. MT 900 RPM

SQUIRREL CAGE MOTORS

200 H.P. Allis Chalmers 1800 RPM
200 H.P. Allis Chalmers 1200 RPM
200 H.P. General Electric 600 RPM
150 H.P. Westinghouse 1800 RPM
100 H.P. G.E. 1200 RPM
100 H.P. General Electric 900 RPM
75 H.P. Westinghouse 900 RPM

A.C. GENERATORS

200 K.W. General Electric 600 RPM
125 KVA G.E. 900 RPM
100 KVA Crocker Wheeler 900 RPM
100 KVA Elec. Machy. 1200 RPM
75 KVA G.E. 1200 RPM
15, 20, & 25 KVA 1200 RPM (8)

LOW & HIGH VOLT. GEN.

200 K.W. Wghse. 600 V. Mtr. Gen Set 800 amp. 10-50 Volts G.E.
2 to 40 K.W. 600 to 2000 V. M.G. Sets (11)
24 K.W. 60 V. General Electric
1 to 75 K.W. 10 to 80 V. (15)

100 KW Westinghouse Syn. MOTOR GENERATOR SET

Motor: 150 H.P. 3 ph. 60 c. 440 V 1200 RPM
Gen. 100 KW 250 Volt 1200 RPM—Complete AC & DC Control Equipment

ANODIC TREATING GENERATORS

3—1600 Amp. General Electric, Syn. 3 unit Motor Generator Sets, 10 to 50 Volts—complete.

4—48 CFM. Ingersoll Rand 125-lb. V Belt driven. New——immediate delivery.

3—667 KVA Gen. Elec. Late Type Transformers. 13800 v. Prim 230/460 v. sec. Good for indoor or outdoor service.

12½ x 12, 390' Amer. Air Comp.
14 x 10 Ingersoll Rand Air Comp.
1 Ton Shepard
15 to 50 K.W. Frequency Changers 90, 100, 120 cycle (7)
5 H.P. B & D D.C. Buffer
Fans & Blowers (19)
Tirrell Voltage Regulators
165 KVA Arc Furnace Transformers

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Reading, Penna. Office: 12th and Spring St.
Over Quarter Century Serving Industry

D.C. EQUIPMENT

230 V. D.C. MOTOR GEN. SETS

100 K.W. West. 1200 RPM
75 K.W. Elect. Machy. 1200 RPM
50 K.W. Burke 1200 RPM
45 K.W. Westinghouse 700 RPM
30 KW GE 1200 RPM

125 V. M.G. SETS

2—100 K.W. Westingh. Syn. Motor
60 K.W. Westinghouse Syn. mtr.
50 K.W. Crocker Wheeler
40 K.W. Westinghouse
35 K.W. Elec. Machy. Syn.
25 K.W. Gen. Elec.

230 V. D.C. MOTORS

75 H.P. General Electric 850 RPM
60 H.P. Sprague 900 RPM
60 H.P. G.E. 1000 RPM
60 H.P. Roth 600 RPM
50 H.P. G.E. 850 RPM
40 H.P. Reliance 625 RPM

330 V. VAR. SPEED MTR.

100 H.P. Crock. Wh. 550/900 RPM
75 H.P. Electro Dyn. 700/1050 RPM
75 H.P. G.E. 1000/1500 RPM
30 H.P. G.E. 825/2000 RPM
25 H.P. G.E. CD 600/1200 RPM
15 H.P. G.E. RF 400/1200 RPM
15 H.P. West. .825/1650 RPM
15 H.P. G.E. 600/1800 RPM
15 H.P. Electro Dyn. 450/1350 RPM

115 VOLT D.C. MOTORS

90 H.P. General Electric 900 RPM
15 H.P. Eck 1500/1800 RPM

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	440–220	G.E.	600
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600
60	220–440	G.E.	720

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

400	440–220	Whse.	276
350	440–220	G.E.	200
250	2300	G.E.	900
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—400 kva., G.E. type H, 13200-440.
3—250 kva., G.E. type H-KD 23000-2300.
3—200 kva., G.E., H-KD 13200-2300.
3—200 kva., G.E. H-KD 6600-2300/4000Y., 25 cy.
3—100 Westinghouse, type SK, 22000/11000-2300.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—200 kva., G.E., type H-KD, 13800-230/460.
2—150 kva., Whse. 4800/4156/2400-480/240.
3—100 kva., G.E. type H, 2300-230/115.
3—100 kva., Whse type, SK, 2300-230/115
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3— 50 kva., G.E. type H-K 2300-230/115.
3— 50 kva., Pittsburgh, 13800-240/120.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse type SK, 13800-240/120.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K, 2300-230/115.
3— 25 kva., G.E., type H-K 2300-230/460.
3—25 kva., Whse type S 2300-575
3— 25 kva., G.E., type H-KR, 6900-230/460.

A. C. GENERATORS

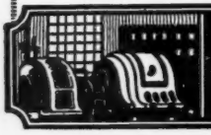
1—500 KVA, 900 r.p.m. 2200 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—219 KVA, 200 r.p.m., 480 V. Whse.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
300	2300/440	G.E.	IE-K	1200
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	1200
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E	K	1800

MOTOR GENERATORS SETS

1—60 K.W., 125 V., 1200 R.P.M. GE, type R.C. con. to 90 H.P., 4150/2300 V., 3 ph., 60 cy., syn. motor.
1—35 kw., 125 V., 1200 r.p.m., G.E., type RC, conn. to KT 50 HP. 220/440 V. 3 ph. 60 cy.
1—G.E., 3 unit set, consisting of 1 type R.C., 10 KW, 250 V., 1750 RPM, and 1 R.C., 10 KW, 125 V. Generators, coupled to K.T. 35 H.P., 220/440 V., 3 ph., 60 cy., S.C. motor.



STEPHEN HALL & COMPANY, INC.

458 Seventh St., Hoboken, N.J.

FREQUENCY CHANGER

1—100 KW, 60/100 cy., Gen. Elec., type ITT-553, secondary volts 375, secondary amps. 190, to a 60 HP, 3 ph., 60 cy., 440/220 V., 1200 rpm, type KT-526 motor; standard Gen. Elec. unit. No accessories.

MOTOR GENERATOR SETS

1—150 KW, 275 V., 900 rpm, type SK, Westgh. to a 225 HP, 3 ph., 60 cy., 230 V., unity P.F., Westgh. syn. motor with A.C. and D.C. panels.
1—300 KW, 275 V., 720 rpm, General Elec., type MPC, to a 430 HP, 3 ph., 60 cy., 2300 V., ATI, Gen. Elec. syn. motor with A.C. and D.C. panels.
1—300 KW, 600 V., 695 rpm., Allis-Chalmers to a 450 HP, 3 ph., 60 cy., 2300 V., 690 rpm, induction motor.

TURBO GENERATORS

1—937 KVA, 750 KW, 3 ph., 60 cy., 2300 V., 3600 rpm, Gen. Elec. complete with C. H. Wheeler surface condenser, pumps, radojet.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

GEORGE SACHSENMAIER CO.

8403 Hegerman St. Phila, Pa.

SYNCHRONOUS CONVERTERS

300 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
300 KW Al-Ch. 250 D.C. 2300/4000 A.C. 1200 RPM
200 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
200 KW Al-Ch, 250 D.C. 2300/4000 A.C. 1200 RPM
200 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

SYNCH. MOTOR GENERATORS

215 KW Al-Ch. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. 250 V. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 V. 2300 A.C. 900 RPM
100 KW WEST. 250 V. 2300 A.C. 900 RPM

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Power & Dist. Transf. from one to 5000 KVA. Any Volt or Frequency.

Motors, Generators, Turbines, Centrifugal Pumps, etc.

A.C. & D.C. Elec'l Meters, Potential & Current Transf. All Makes. Scales Calibrated to your requirements.

Catalog & Prices on Request

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FOR SALE
DIESEL ENGINE

450 H.P. Bessemer Solid injection Full Diesel Engine, 225 R.P.M., 4 Cylinder, 4 Cycle, 15" Bore x 22" Stroke, Tex Rope Drive to 300 K.W. G.E. Generator, 3 Phase, 60 Cycle, 2300 volt with Switchboard and G.E. Tyrell Voltage Regulator.

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COMPLETE POWER PLANTS

For Immediate Shipment

2000 KW TURBO-GENERATOR

Westinghouse 2857 KVA @ 70% P.F. with 4700 Sq. Ft. Surface Condenser

Also—1500 KW Turbo Non-Condensing

back pressure up to 30#

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A new Lot of Reconditioned Transformers acquired—200KVA and down. Let us have your inquiries.

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Specialists on Rebuilding Motors, Generators and Controls

1410 No. 6th St., PHILA., PA.

QUALITY ELECTRICAL EQUIPMENT

1—Westghse CS, 500 HP, 450 RPM, squirrel cage motor, originally 2200 v., 3 ph., 60 cy.; needs winding; will rewind any voltage at above rating, or change H.P. and speed within limits of frame cap.

We have large stock all kinds equipment. Send us your inquiries.

JACKSON-BAYLEY ELECTRIC CO.

CANTON OHIO

SPECIALS

2500 KW G.E.-Curtis Turbo-Gen. Set, 375# P.
300 & 500 KW Non-condensing Turbo Gen. Sets
10,000 Sq. Ft. Wheeler Surface Condensers
100 HP Synchronous Motor—all complete
55,000 Gallon Steel Water Tank & Tower
375 HP, 200#, B&W Water Tube Boiler
65 KW, 240-3-60-Gen. D/C Steam Engine
Seam Welder
Diesel Engines—all sizes—slow & high speed.

H. & P. MACHY., 5819 Enright Ave., St. Louis.

300 KW ROTARY CONVERTERS

1—300 KW Burke Rotary Converter, 250 volts D.C., rolled steel frame, 6 phase, 60 cycles with transformer and swbds.
1—300 KW Westinghouse Rotary Converter, 600 volts D.C. 6 ph. 60 cy., pedestal bearings, 1200 RPM.

TRANSFORMERS

3—200 kva Moloney Type HE Transformers, single phase, 60 cycles, 2200/4400-240/480 volts. Also from 1 kva to 750 kva sizes in stock.

75 KW MOTOR GENERATOR SET

2—75 KW GECo Induction MG Sets, 250 V-DC, 3-60-220/440 V-AC, 1200 RPM, with switchboards.

ELECTRIC EQUIPMENT

FOR

INDUSTRY

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MILL & CRANE MOTORS D.C.
SQ. CAGE & SLIP RING MOTORS A.C.
SYNCHRONOUS MOTORS A.C.
TRANSFORMERS

CRANE MOTORS

1—MDS 109½, 1—MC90, 2—38-B, 1—CO 1812, 1—MDS 108, 1—CO 2007, 3—CO 2004, 2—12A, 1—48.

MILL MOTOR

1—Type MCOB Frame 80 Westghse, 230 volt, back geared, 130 HP, 430 RPM, ¾ hour to 75 HP, 500 RPM, 1 hour.

ELECTRIC FURNACE

1—300# Detroit Electric Furnace, Type LFA for 440 volts A.C. Used 6 months.

150 KW MOTOR GENERATOR SETS

2—150 KW Gen. Electric Synch. Motor Generator Sets 500 volts D.C., 3-60-2300 volts A.C. with swbds.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

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MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
5) 75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Burke	720	EM	10
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720	I	K

Compressors in stock up to 300 H.P.

AIR COMPRESSORS

1—14"x9"x12" Imperial-Type Ingersoll-Rand two stage 100 lb. pressure belt drive.
1—16"x10"x14" Imperial-Type Ingersoll-Rand two stage 100 lb. pressure belt drive.

BARGAIN

30—3 HP. General Electric Motors. 3/60/220/3600 rpm. $37.00 each.

100 K.V.A. GENERATOR For Diesel Use

1—100 KVA Crocker Wheeler 3/220/60 cy. 257 RPM. For Direct connection to Diesel. 2 Bearing Machine with exciter and panels.

ANODIZING M. G. SET

1—1000 Amp. 60 Volt General Electric Generator, Type CD-115Y, 1200 RPM, direct connected to 90 H.P. General Electric Synchronous Motor, 3 phase, 60 cycle, 440 volt, 1200 RPM; 3-bearing Factory built machine, complete.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM.
1—500 H.P. Gen. Elect. Sync. 3/2200/60/1200 R.P.M. with Exciter. New.
500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.
300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.
225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.
2—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

FREQUENCY CHANGERS

1—600 KW Gen. Elec. Syn. 2300 V., 25 cy. to 2300 V. 60 cy.
1—565 KVA Westinghouse Synch. 2200 V. 25 cy. to 220 V. 3 Ph. 60 cy.
2—400 KW General Electric Synch. 6600 V., 25 cycle to 440/2300 V. 60 cy.

TRANSFORMERS

Amt.	KVA	Make	Cycle	Voltage
3	40	Gen. Elec.	25	2200/440
3	50	Gen. Elec.	60	2200/220/440
2	75	West.	60	2200/120/240
3	100	Gen. Elec.	60	24/120/240
2	100	Gen. Elec.	60	4600/115/230
3	200	Gen. Elec.	25	13,200/240/480
3	333	Gen. Elec.	60	6900/230/460
3	500	Gen. Elec.	60	2200/220/440
3	500	Pittsburgh	25	11,500/100
3	833	Gen. Elec.	60	13,800/460
3	1000	Pittsburgh	60	2300/4600/115
3	1000	KVA. Wagner	60	33000/2300

All sizes and Voltages Available

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec. (2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HF	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	545
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1725
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. E ec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	5264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4817983	750
40	Gen. Elec.	MT343	3887755	750

GENERATOR & EXCITER

1—62½ KVA 3 ph. 60 cy. 240 v. 1200 rpm Allis-Chalmers generator, serial No. 113797, with exciter, direct Connected stock No. E11317. Comp. with Base Pulley and Panel.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

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HIGH-PRESSURE ASME & NATIONAL BOARD

INDUSTRIAL-POWER AND HEATING

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59 FLUSHING AVE. Main 4-5880 BROOKLYN, N. Y.

ENGINE GENERATOR SETS

1—160 KW West. 3/60/480 Belted Exct. Dir. con. Chuse left hand 4 val. non-release eng. 17x21.
1—312 KVA West. 3/60/2300 v. belt, exct. dir. con. Murray Special Corliss left hand eng. 18x30.

AIR COMPRESSORS

1—610 c. ft. I.R. St. Dr. 100# air, 150# stm.

SURFACE CONDENSERS

2—10 AD 4 pass 210 ft. Foster Wheeler over Comb. Air Circulating and Tail pump.

STEAM PUMPING ENGINES

1—Snow 6 mgd C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. Fine cond.

PUMPS

Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

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2—125 H.P. Locomotive. Fire Box boilers 250# pressure.
1—525 H.P. 200# Springfield Cross Drum Boiler.
4—500 H.P. Stirling 160#.

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200	Al. Ch.	600	S.C.	
150	West.	720	S.C.	CS
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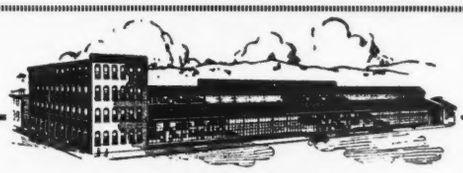

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3—500 KW General Electric, 600 volts, D.C., direct connected to 700 HP, 720 RPM, 2500/5000 volts, 3 phase, 60 cycle Synchronous Motor with direct connected exciters.

MOTOR GENERATOR SETS (Con't.)

1—250 KW Allis-Chalmers, 120 volts, 750 RPM connected to a 350 HP 2200 volt, 25 cycle, 3 phase, synchronous motor.

STEAM ENGINE GENERATORS

1—125 KW, 125 volt, 250 RPM, Westinghouse Generator connected to a 15" x 16" Skinner Automatic Engine.

1—200 KW, 125 volt, 210 RPM, General Electric, Type MP connected to a 15 & 25" x 20" Tandem compound, right hand Skinner Engine.

2—300 KW Elliott, 250 volts, D.C., 165 RPM, connected to 21x28", 4 valve Automatic Type M Engines.

THE GLOW ELECTRIC COMPANY

945 HARRIET ST. Phone MA. 3024 CINCINNATI, OHIO

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS, 3 phase, 60 cycle, A.C.

250 KW G.S. Rotary 275 Volt D.C. 2300 Volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
75 KW West. M.G. Set 250 V. D.C. 440 V. A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.
15 KW Burke 125 Volt D.C. 220 Volt A.C.

SYNCHRONOUS MOTORS 3 phase 60 cycle

2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt
G.E. 60 HP 720 RPM 440/220 Volt

SLIP RING MOTORS 3 phase 60 cycle

West. 150 HP 720 RPM 550 Volt
G.E. 60 HP 720 RPM 440/220 Volt
Allis-Chalm. 250 HP 600 RPM 440/220 Volt
Burke 100 HP 1200 RPM 440/220 Volt

ADJUSTABLE SPEED 230 Volt D.C. Motors

1—G.E. RF-18 90/120 HP 400/1200 RPM
1—G.E. RF-17 50/100 HP 450/1200 RPM
1—Reliance 1400-T 100/125 HP 300/900 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
1—Diehl 50 HP 400/1200 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
2—Crocker-Wheeler 125-H 50 HP 175/700 RPM
1—West. SK-143 40 HP 500/1500 RPM
2—Reliance 461-T 40 HP 475/1500 RPM
1—Allis-Chalm. 35/70 HP 450/1350 RPM
1—Allis-Chalm. 25 HP 600/1800 RPM
1—G.E. CD-93 15 HP 500/1500 RPM
2—West. SK-123 5 HP 300/1200 RPM enclosed

The Electric Motor & Repair Co., Cuyahoga Falls, O.

HART and CROUSE COMPANY

3 BOILERS

1—#410 Royal smokeless sectional water tube boiler of 65 B.H.P. at 15# steam pressure double grates, upper set water circulation and lower rocker pattern.

2—#S557 Royal smokeless sectional water tube boilers of 150 B.H.P. at 15# steam pressure, double grates, upper set water circulation and lower rocker pattern, with duplex automatic water feeder.

All used only four heating seasons.

BOYERTOWN BURIAL CASKET CO.
BOYERTOWN, PA.

STOCK SHIPMENTS

DIESEL

1—INTERNATIONAL PD-40 Power Unit
60 H.P. F & M 3/60/2300—F & M Gen.
80 H.P. ATLAS—Belted
132 H.P. FULTON—D/C to West. 100 Kva. Gen.
2—55 H.P. BRUCE MacBETH NAT. Gas Engines
240 H.P. F & M 3/60/2300—F & M Gen.
2—300 H.P. F & M 3/60/2300—F & M Gen.
1—360 H.P. F & M 3/60/2300—F & M Gen.

STEAM

80 H.P. BALL 53 K.W. 125/250 Volt 3 Wire Westinghouse Generator
95 H.P. AMES-Unaflow
125 H.P. SKINNER—Center Crank
300 H.P. RIDGWAY 4 Valve 250 KVA 3/60/2300 Ridgway Generator

SPECIALS: 3 175 h.p. 150 rpm Westing-House Syn. Motors

Beeson Brothers Supply Company
1000 Alhambra Ave. Los Angeles, Calif.

FOR SALE

BOILERS

Two (2) Dillon 250 H.P., H.R.T. boilers, 135 lbs. WP., perfect condition, with all trimmings, coal or oil, ready for assembly. Write

WARREN CONTRACTING CORP.
202 East 56th St. New York City

Condensing Turbine Unit

375 KVA G. E., 4 Stage, Form B, 200 lb. steam, 240 Volts, 3 phase, 60 cycle, 3600 RPM, equipped with S & K multi-jet condenser, without exciter, with two Goulds condenser pumps and common base, but without motor.

CONTINENTAL-DIAMOND FIBRE COMPANY
NEWARK, DELAWARE

FOR SALE

Engine Generator Set

250 K.W. Vilter Corliss 150#
Engine Generator Set 550 Volt D. C.
125 R.P.M.

CITY OF STOUGHTON, WIS.

Re-built Motors and Generators

2—75 HP, 2200 V, **Fairbanks Morse,** 1800 RPM, 3 PH, 60 CY slip ring motor, direct connected to 500 GPM 3 stage 300' head pump.

1—400 HP **Westinghouse,** type CW, 3 PH, 60 CY, 440 V, 450 RPM slip ring motor.

3—350 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 600 RPM slip ring.

1—300 HP **Allis Chalmers,** 3 PH, 25 CY, 440 V, 485 RPM slip ring.

2—250 HP **Westinghouse,** type CS1012, 3 PH, 60 CY, 440 V, 435 RPM sq. cage.

1—200 HP **Westinghouse** syn. 1 PF, 3 PH, 60 CY, 2200 V 600 RPM with direct connected exciter, 3 or 2 bearing.

2—150 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 450 RPM slip ring.

2—150 HP **Westinghouse,** type CW, frame 1000, 2 PH, 60 CY, 440 V, 450 RPM slip ring.

2—100 HP **Westinghouse,** type CS, frame 754 C, 3 PH, 60 CY, 440 V, 870 RPM sq. cage.

3—150 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 1750 RPM sq. cage.

1—100 HP **Westinghouse,** type CCL, 3 PH, 60 CY, 2200 V, 1750 RPM sq. cage.

1—100 HP **Wagner,** type 26V5BP, 3 PH, 60 CY, 440 V, 860 RPM sq. cage

2—100 HP **Allis Chalmers,** type ANY, 3 PH, 60 CY, 440 V, 690 RPM slip ring.

1—100 HP **Westinghouse,** type SK, frame 160, 230 V, 1100 RPM.

1—100 HP **Allis Chalmers,** type ANY, 3 PH, 60 CY, 2200 V, 690 RPM slip ring.

1—75 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 450 RPM slip ring.

1—75 HP **Westinghouse,** type CW, 3 PH, 60 CY, 440 V, 720 RPM slip ring, 3 or 2 bearing.

1—75 HP **Fairbanks Morse,** type H, frame 165 C, 3 PH, 60 CY, 550 V, 900 RPM sq. cage.

2—75 HP, **General Electric,** type I, 3 PH, 60 CY, 220 V, 720 RPM sq. cage.

1—75 HP, **General Electric,** type MT, frame 337, 220 V, 3-60-1745 RPM.

1—75 HP **Lincoln,** type IQ, 2 PH, 60 CY, 440 V, 600 RPM sq. cage.

1—75 HP **Finn-Weiksel (Wagner)** ty. 26VRN, 3 PH, 60 CY, 220 V, 1200 RPM syn.

1—250 HP **Crocker Wheeler,** type CCM, size 151 H, 230 V, 600 RPM, DC

3—100 HP **General Electric,** type CD, frame 123, 230 V, 1200 RPM DC

1—60 HP **General Electric,** type CD, frame 115, 230 V, 850 RPM, DC

1—50 HP **Westinghouse,** type SK, frame 160, 230 V, DC, 565 RPM

1—50 HP **General Electric,** Class 6, Form B, 600 V, DC, 600 RPM

1—50 HP **Ideal,** type SMS, 3 PH, 60 CY, 220 V, 1800 RPM, synchronous.

1—60 HP **Westinghouse,** type SK, frame 160, 230 V, DC, 680 RPM

1—60 HP **C&C,** 230 V, DC, 250/1000 RPM

1—75 HP **General Electric,** type CD, frame 176, 550 V, DC, 250/1000 RPM

3—75 HP **Westinghouse,** type SK, frame 150, 230 V, DC, 1100 RPM

1—100 KW **General Electric,** type DLC, 125 V, DC, 440 V, AC M-G set.

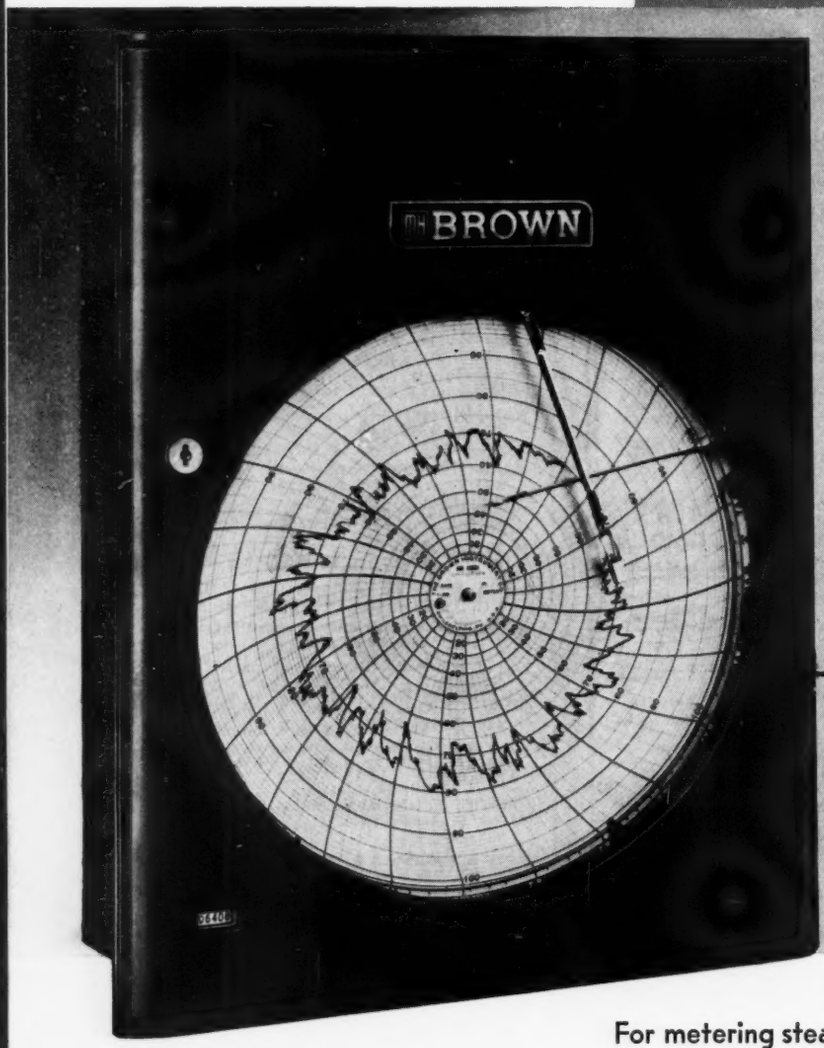
1—60 KW **General Electric,** type DLC, 150 V, DC, 220 V, AC M-G set

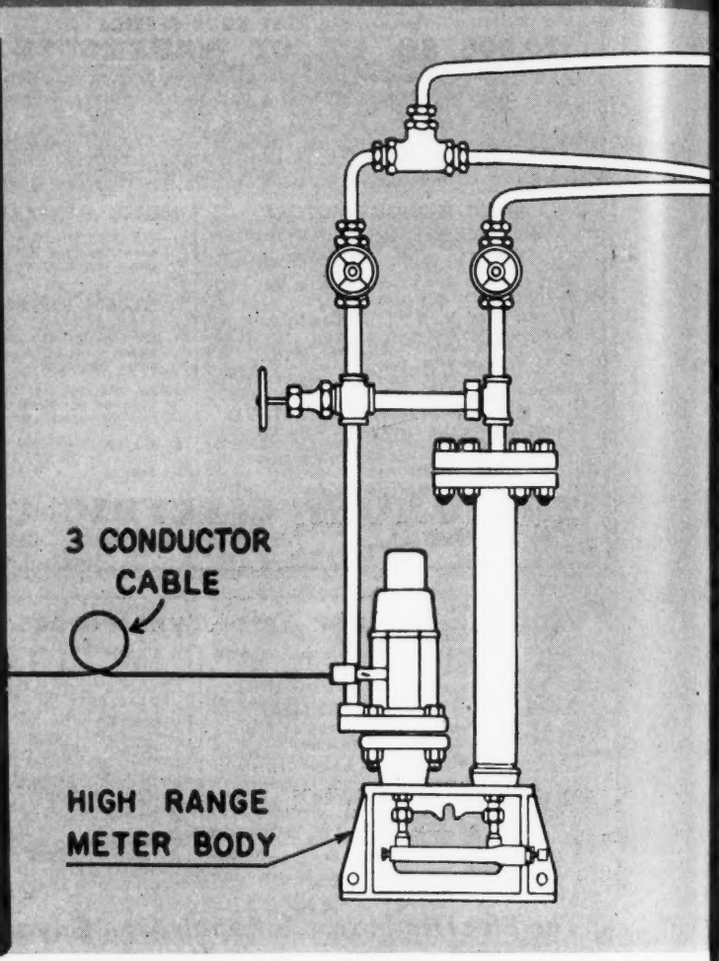
The Wente Electric Co.

207 N. Fourth St. Hamilton, Ohio

Est. 1903

Ideal for WIDE RANGE FLOW





HIGH RANGE METER

For metering steam where the flow varies over extremely wide ranges, the Brown Flow Meter System shown above, fulfills every requirement for high pressure steam heating and process loads.

The system consists of two meters connected to the same orifice. The low range meter records and integrates the flow from 0 to 25 per cent of maximum.

The high range meter records and integrates flows from 25 per cent to 100 per cent of maximum. The sum of both integrator readings gives the total steam flow. The change from one meter to the other is automatic and requires no manual operation.

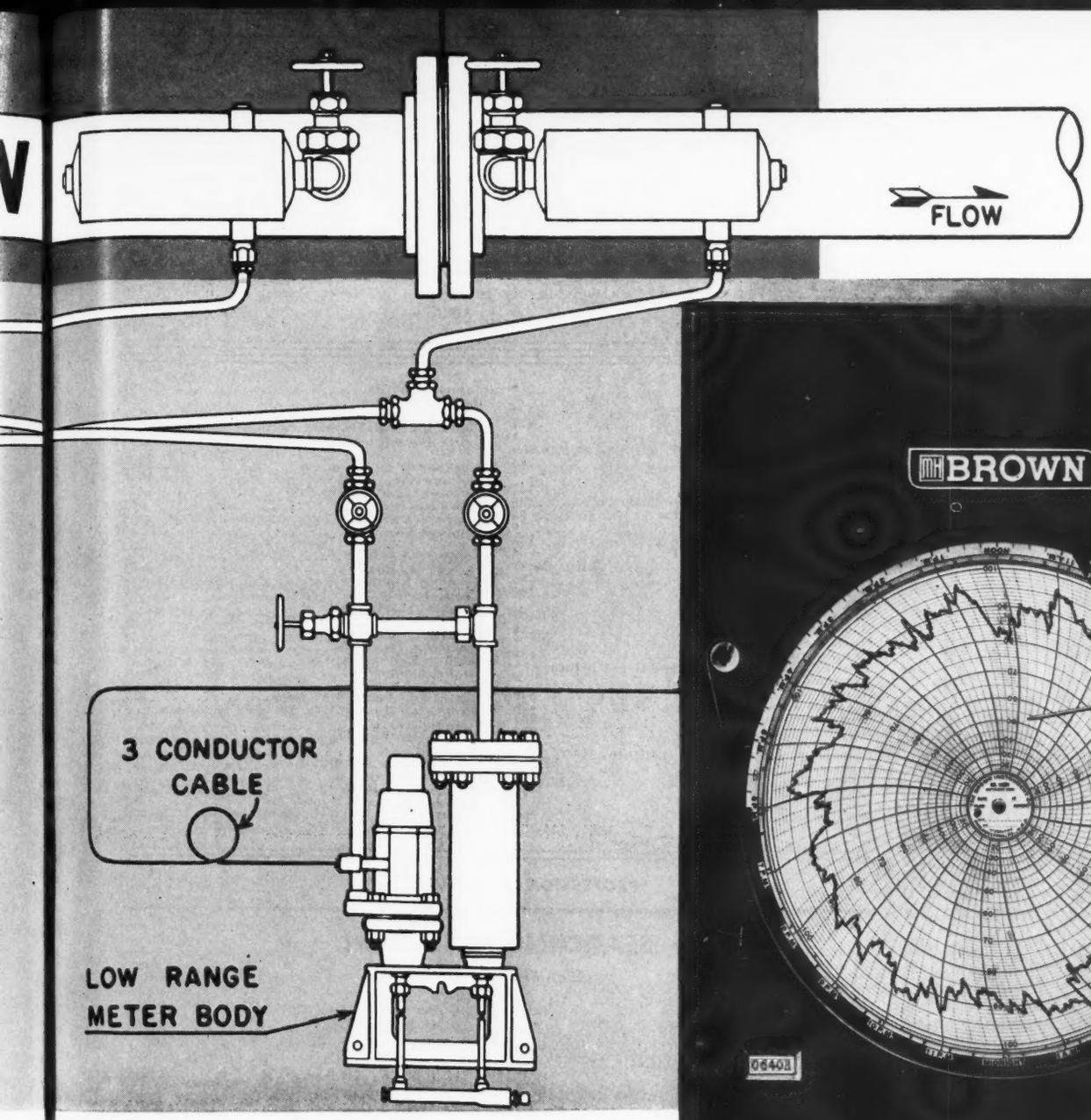
Either or both meters can be supplied with auxiliary indicating scales and can be equipped with air control features in case it is desired to limit the maximum flow.

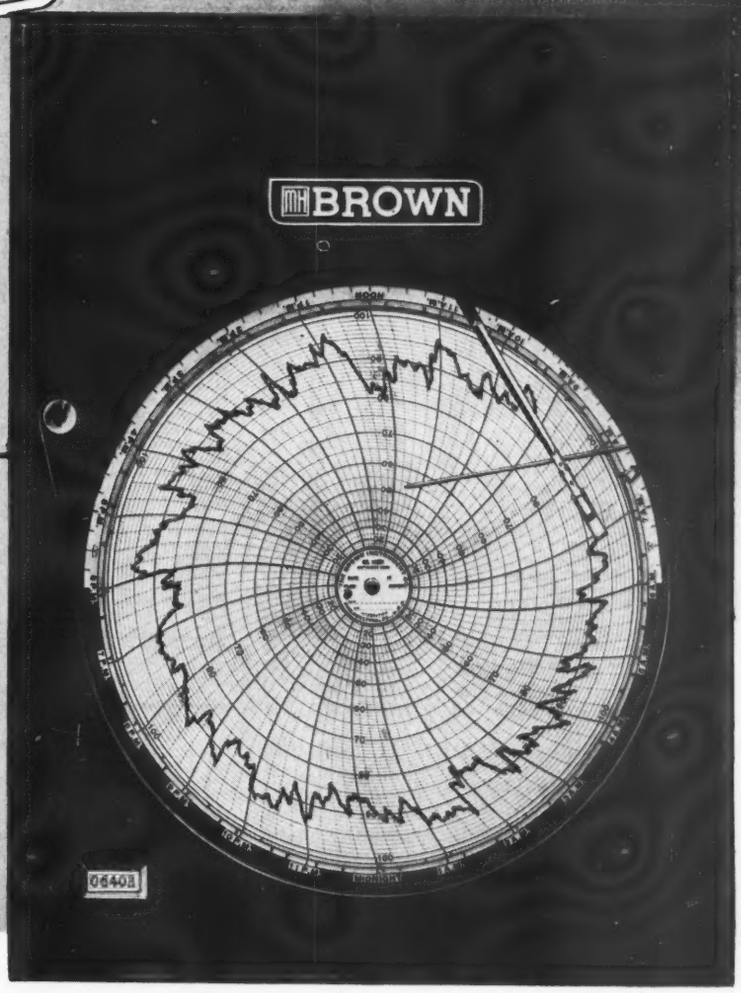
To Economize . . .

Measure and Record

STEAM Flow from each boiler.
STEAM Flow to auxiliaries.
STEAM Flow to individual units.
STEAM Flow from bleeders.
STEAM Flow to factory departments.
STEAM Flow to heating system.
STEAM Pressure on main header.
STEAM Pressure at feed water heater.
STEAM Pressure at all units.

BROWN





Brown Flow Meters are a guarantee of satisfaction to both the user and producer—for example, in the City of Washington, D.C., there are more than thirty stations where steam is measured by this practical method.

The Brown Wide Range Meter System is easily installed in large and small central distribution plants where accurate accounting is a requisite.

Write for Catalog No. 2007. THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4490 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street — England: Wadsworth Road, Perival, Middlesex — Stockholm, Sweden: Nybrokajen 7.

LOW RANGE METER

Operating Advantages

1. Operates on the Inductance Bridge Principle! Inherently independent of voltage changes.
2. AUTOMATIC PLANIMETER PEN gives you a record on total flows over any period of time.
3. SIX INTERCHANGEABLE RANGE TUBES assure quick adjustment to changes in operating conditions.
4. INTEGRATOR DIAL. Easy to read. Simple counter—plain figures. Read it like your automobile mileage indicator.

Flow Meters

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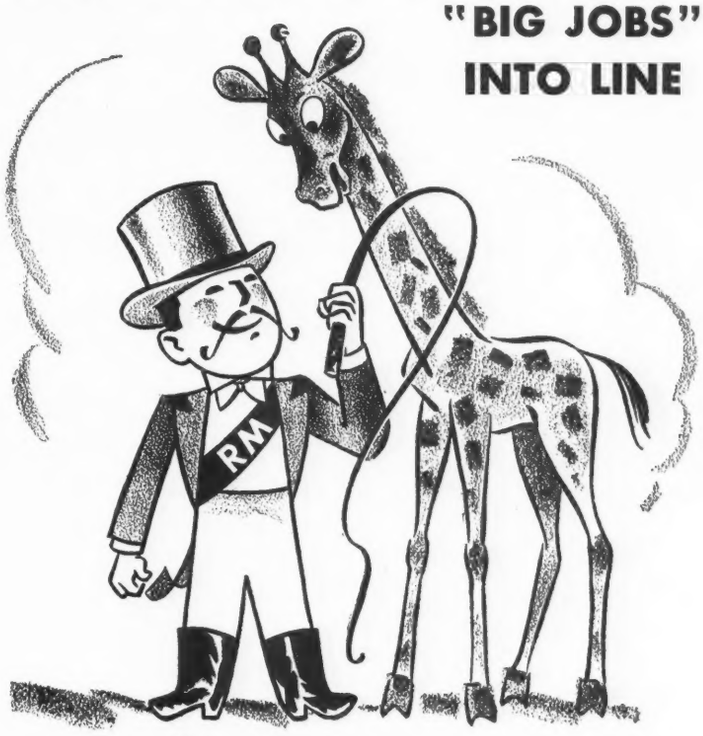
R/M PACKINGS WHIP THE "BIG JOBS" INTO LINE



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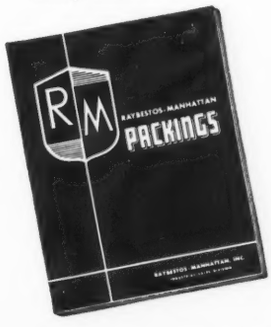

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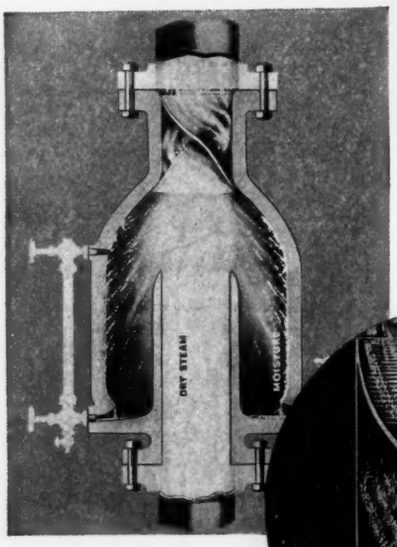
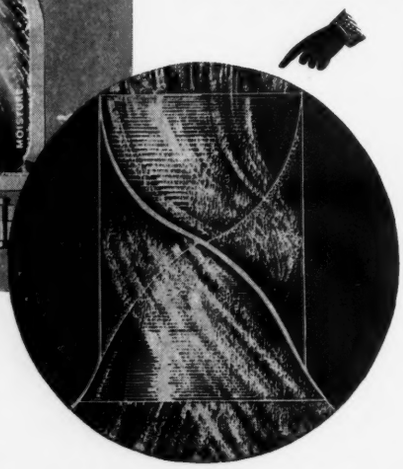
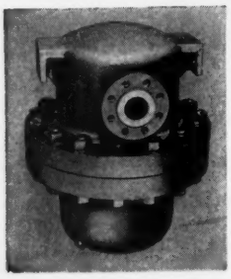
Whirl the costly hazards out of your steam with Swartwout Separators

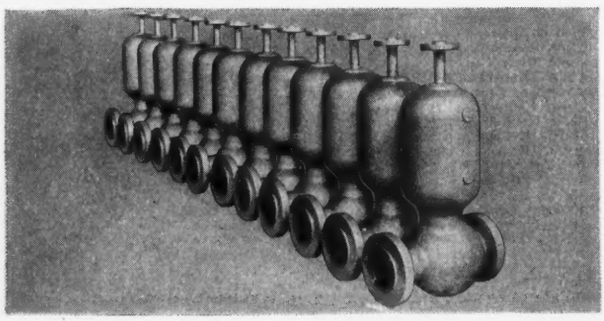
Positive separation, without pressure loss





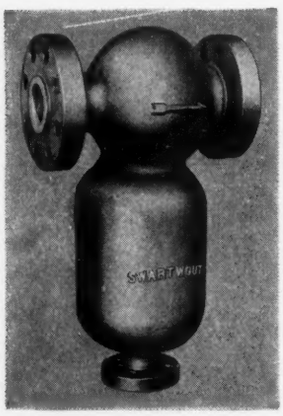


Special Swartwout Separator takes the "water blurp" out of a *steam* whistle. Hot steam is whirled dry—gives the whistle a clear strong blast *immediately.*

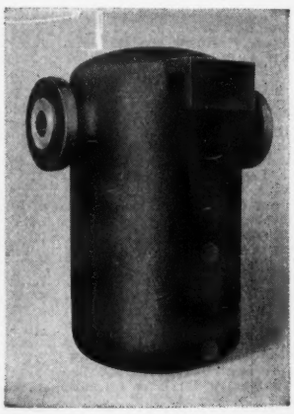


Where dry steam is very essential, these Swartwout high pressure Separators protect auxiliary equipment *aboard ship.*

Nearly five thousand of these Swartwout Loco Separators are in use as *standard* accessories in a special type of equipment where space and weight limitations are important.



Swartwout 900 lb. standard Separator protects high pressure turbine during *wash down period.*



A Swartwout Separator and receiver in cast steel construction, for marine service. Has large storage capacity.

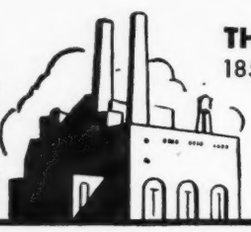
These Swartwout AIR Separators operate on the same principle as the *steam* units. Remove oil and water effectively from compressed air *near the work.*

YOU'LL APPRECIATE the *simple, sure* separating action of the *helico-centrifugal principle* used in Swartwout Separators. No slugs of water can slip by to ruin engine or turbine; no dirty oil or grease to spoil work in process. "It's the *whirl* that does the trick." Write today for Separator Bulletin S-14-B.

Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

Swartwout

•Power Plant Equipment•

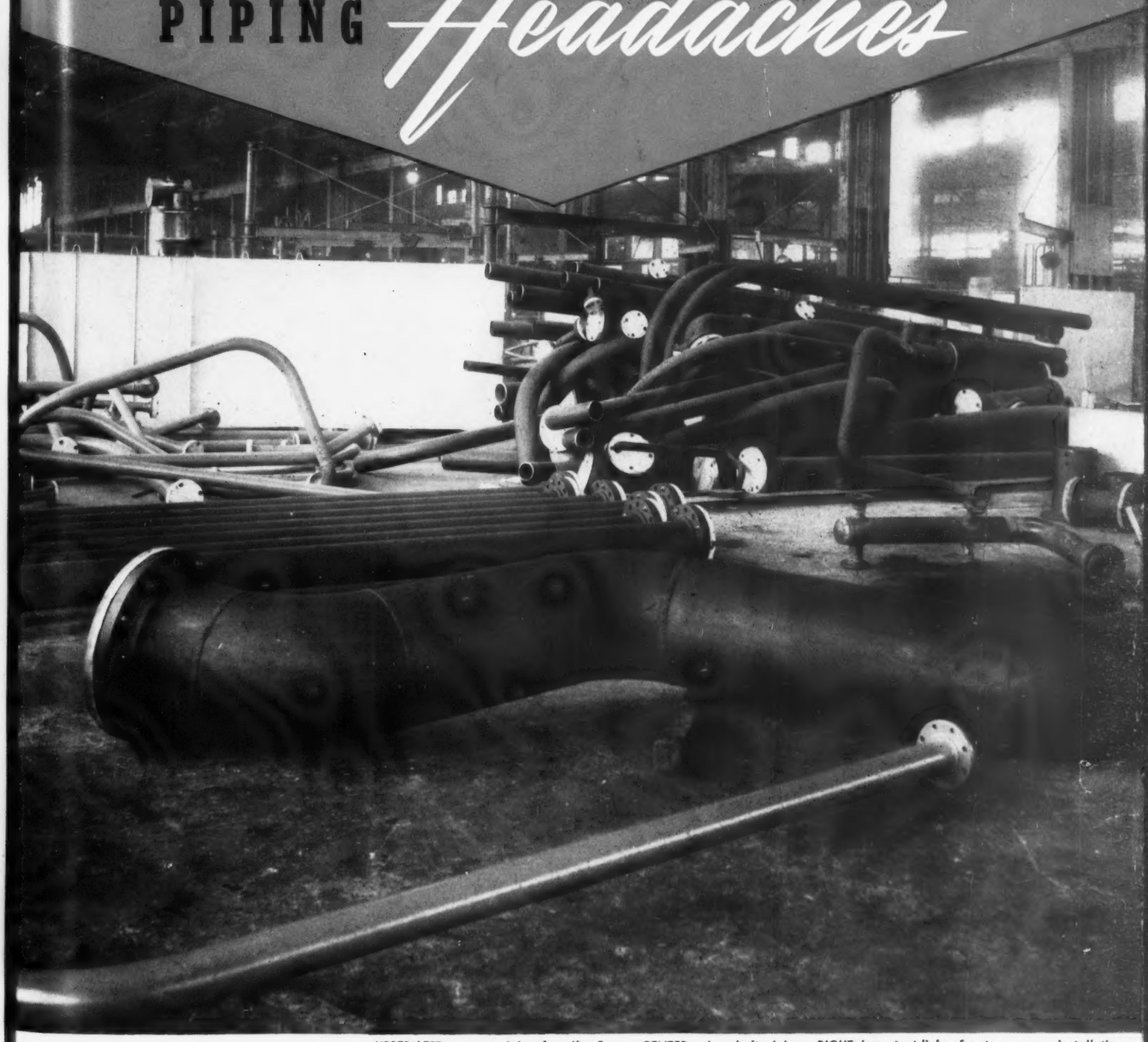


THE SWARTWOUT COMPANY
18501 Euclid Avenue • Cleveland, Ohio

★ ★ ★

Controlled **AIR CIRCULATION**
for Power Plants and Industrial Buildings

THREE INDUSTRIES SUB-CONTRACT PIPING "Headaches"



UPPER LEFT, process piping for oil refinery. CENTER, mine shaft piping. RIGHT, important links of a steam power installation.

THREE different industries – a power plant, an oil refinery and a mining operation – escaped the "headaches" of new piping installation when they *sub-contracted* the prefabrication to Grinnell!

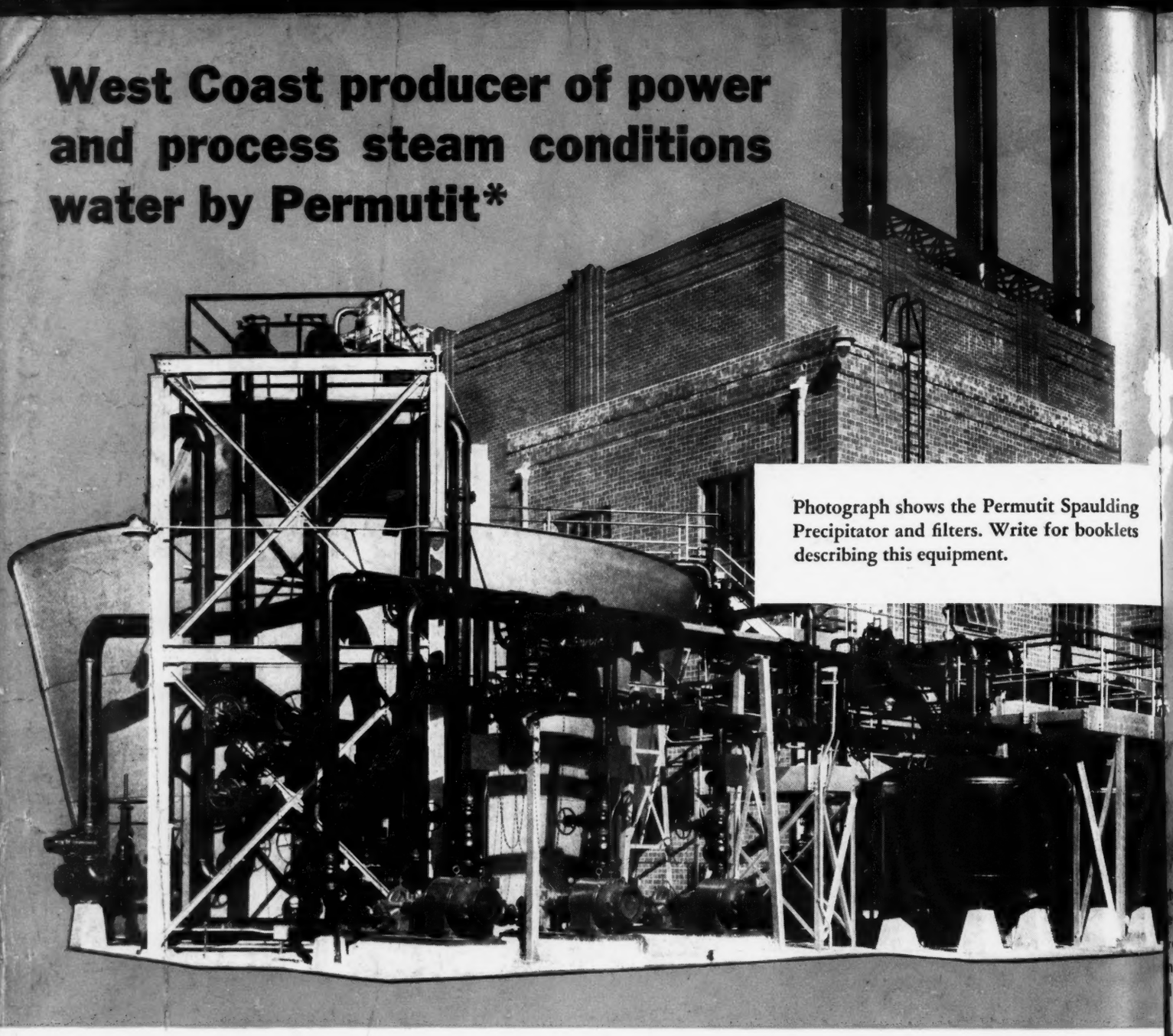
Grinnell engineers are specialists, qualified by long experience to interpret any piping problem. Grinnell plants, strategically located to serve all industries, are equipped with every last facility to prefabricate the most complex sub-assembly and deliver it on the job ready for fast assembly.

Save yourself a big part of the worries connected with extensions in power or process piping . . "Give the Plans to Grinnell". That's how leading manufacturers, utilities and process plants are meeting boosted wartime demands. Write for Data Book, "Grinnell Prefabricated Piping". Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch Offices in principal cities of the United States and Canada.

GRINNELL

WHENEVER PIPING IS INVOLVED

West Coast producer of power and process steam conditions water by Permutit*



Photograph shows the Permutit Spaulding Precipitator and filters. Write for booklets describing this equipment.

★ This is an interesting plant. Power is produced by 1500 psi. boilers which operate a turbine. Steam is extracted from a stage in the turbine, whence it goes to four evaporators which produce process steam at 150 psi. The high pressure boilers are fed condensate from the evaporators and surface condensers.

For protection of evaporator tubes against scale, and for control of the quality of process steam, which should be low in moisture and free CO_2, the water used for such steam production must first be conditioned to low alkalinity and zero hardness. The raw water is a surface supply, high in turbidity, hardness and alkalinity. The treatment consists of clarification and partial reduction of hardness in a Permutit Spaulding Precipitator, followed by filtration. Hardness is then reduced to zero in a Permutit Zeo-Karb* softener after which the alkalinity is reduced to the desired point by supplementary sulfuric acid treatment.

When you have a difficult water treatment problem, call on The Permutit Company for recommendations best adapted to your water supply and plant needs. Permutit manufactures a full line of water conditioning equipment and maintains an engineering staff of wide experience, which is available at any time to meet with you and your consultants. Address: The Permutit Company, Dept. A, 330 West 42nd Street, New York, N. Y.

*Trademark Reg. U. S. Pat. Off.

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